

FIG. 1A

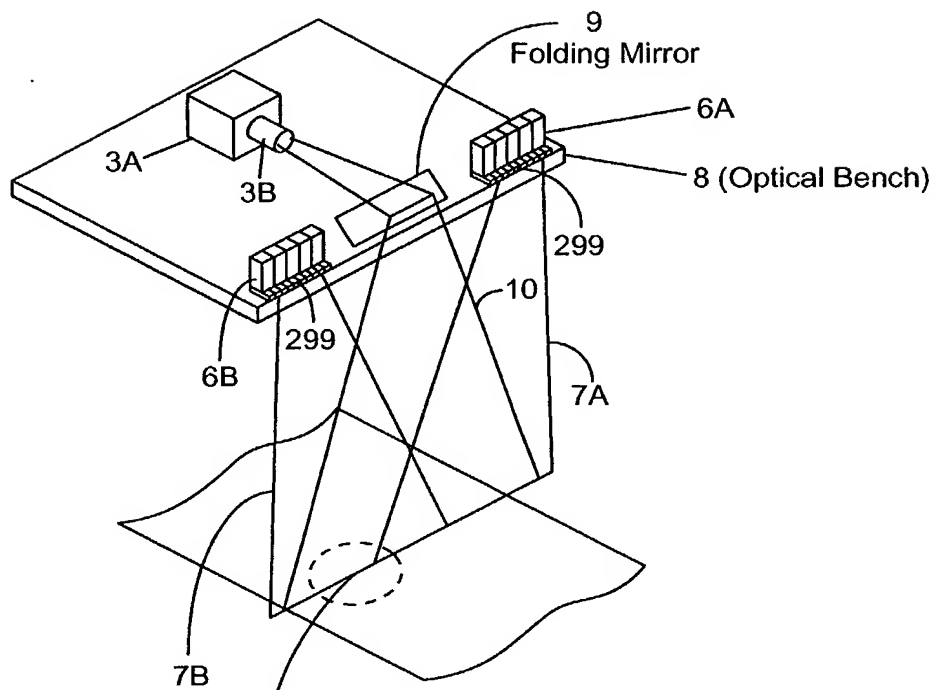


FIG. 1B1

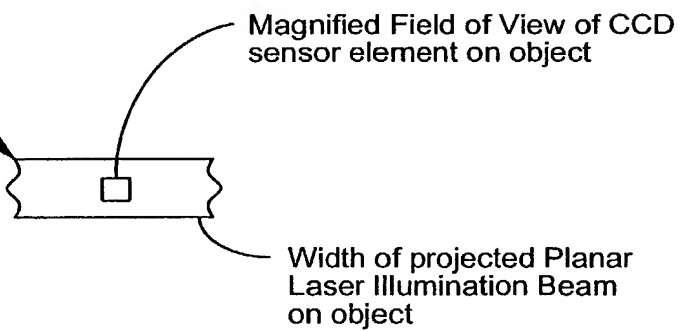
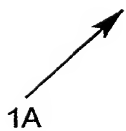
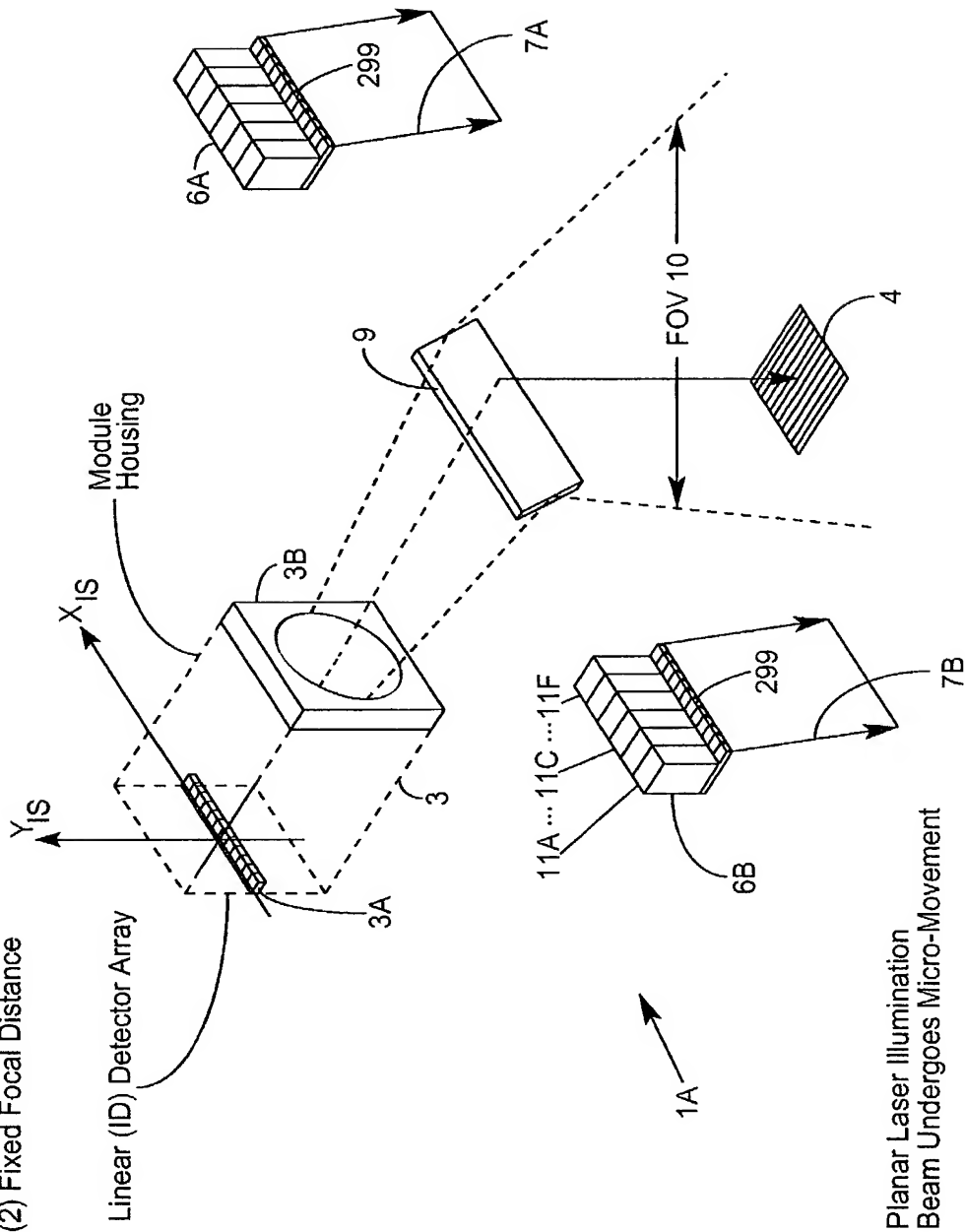


FIG. 1B3

- (1) Fixed Focal Length Camera Lens
- (2) Fixed Focal Distance



Planar Laser Illumination  
Beam Undergoes Micro-Movement

FIG. 1B2

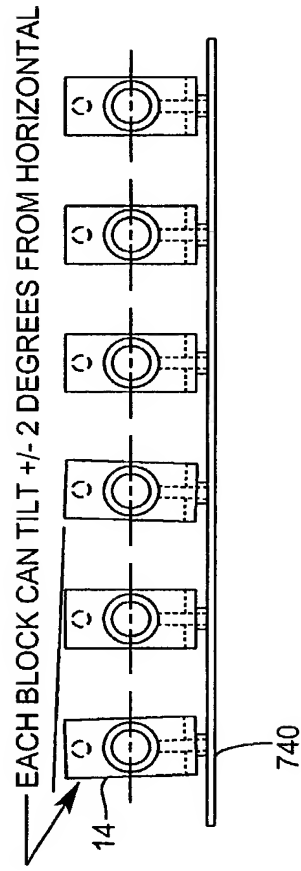


FIG. 1B4

VLD BLOCK CAN PITCH FORWARD FOR ALIGNMENT WITH OTHER VLD BEAMS

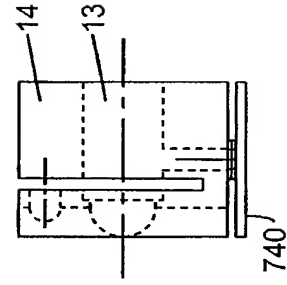


FIG. 1B5



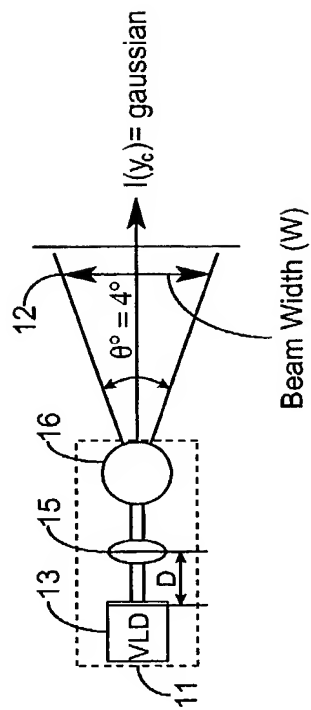
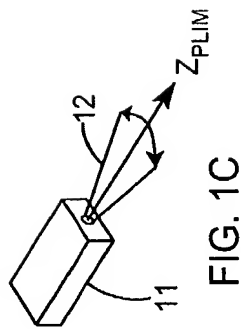


FIG. 1E1

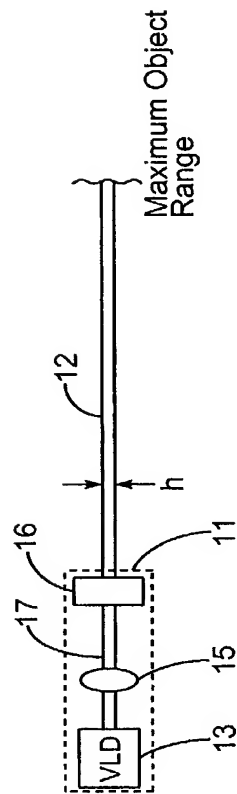
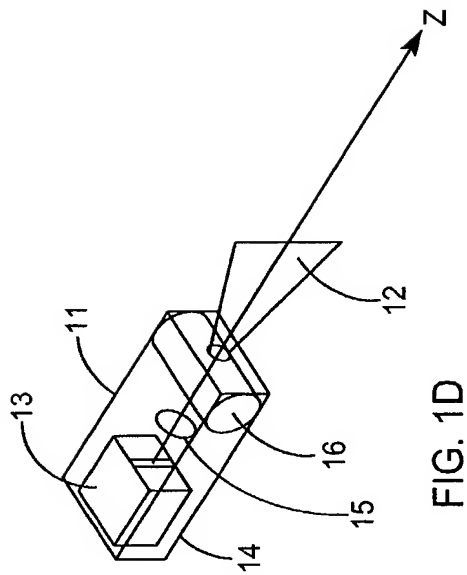


FIG. 1E2

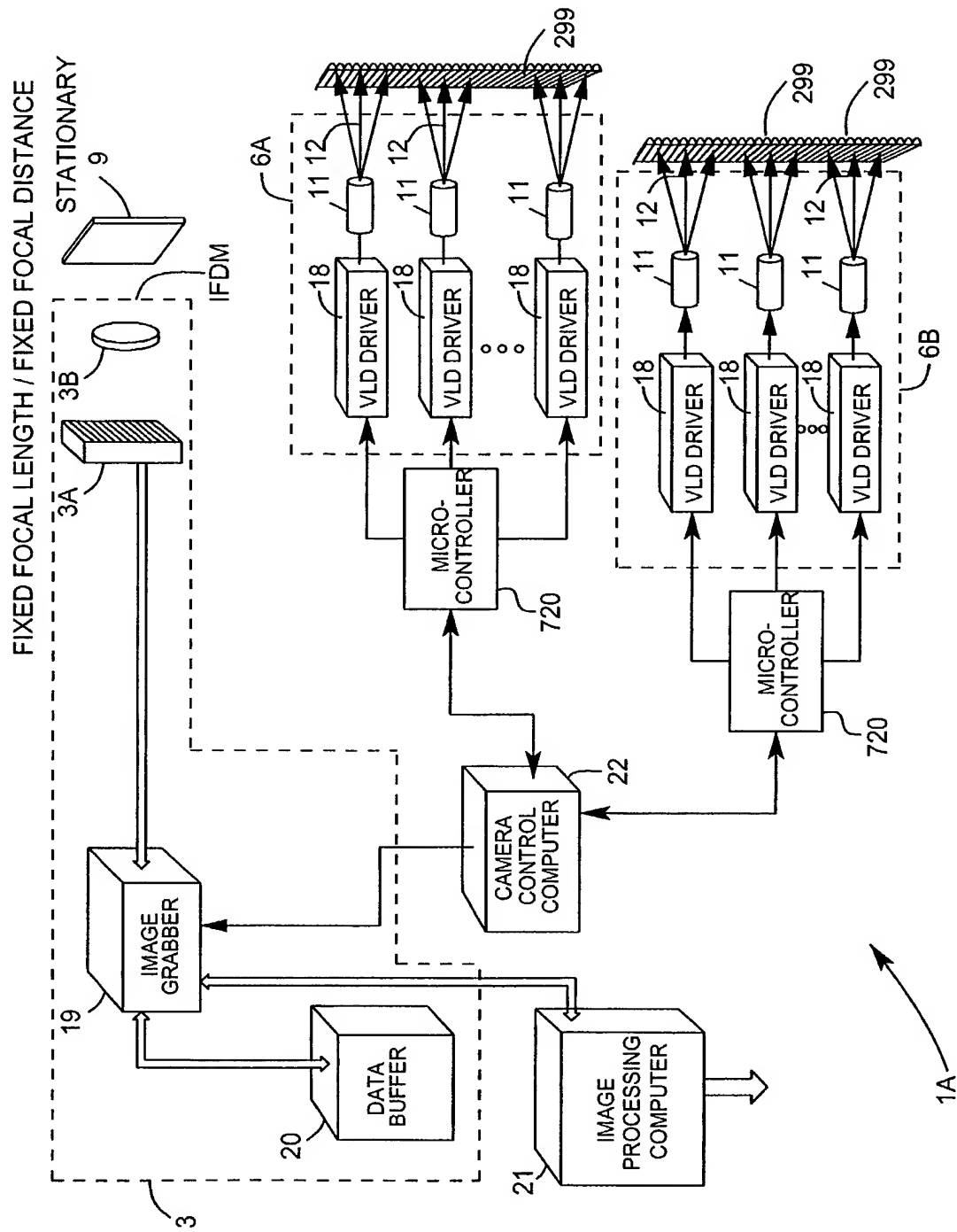


FIG. 1F

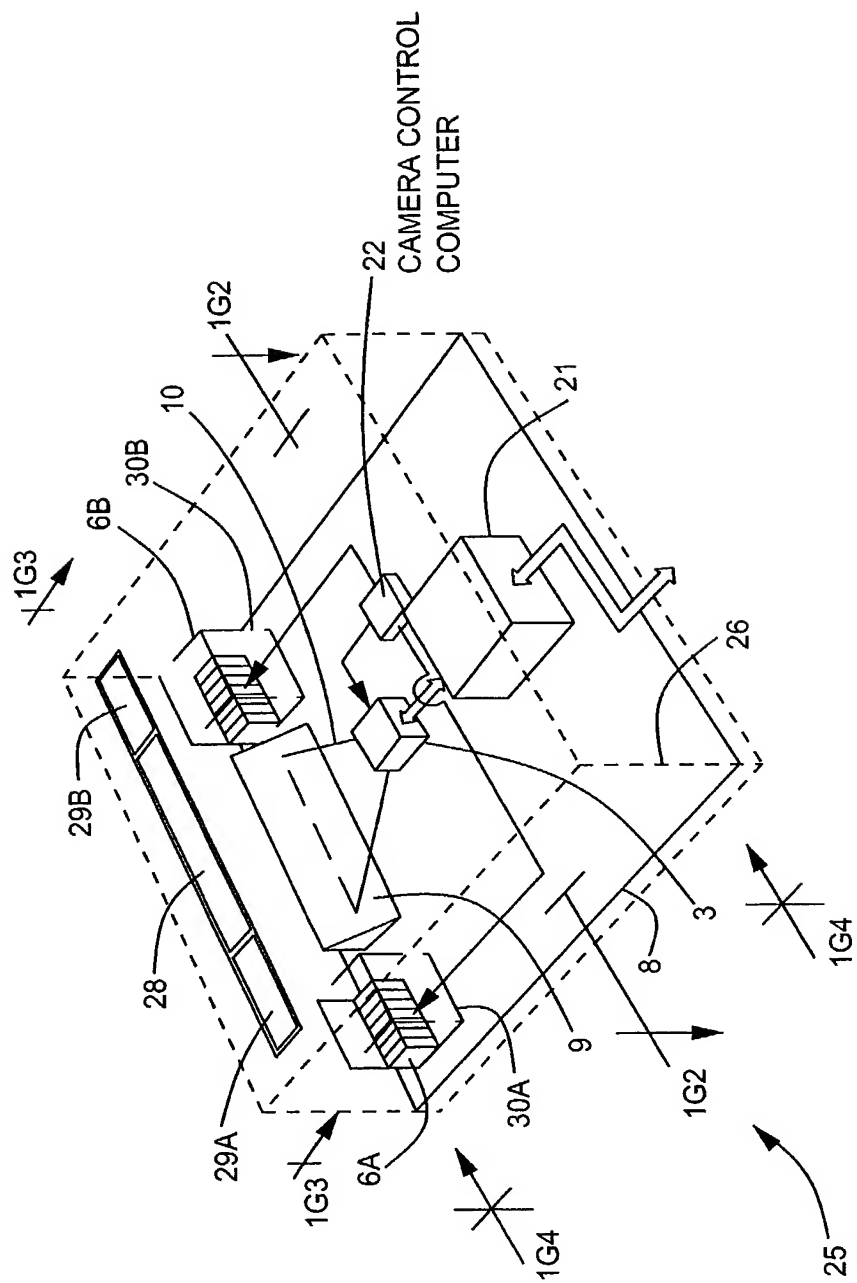


FIG. 1G1

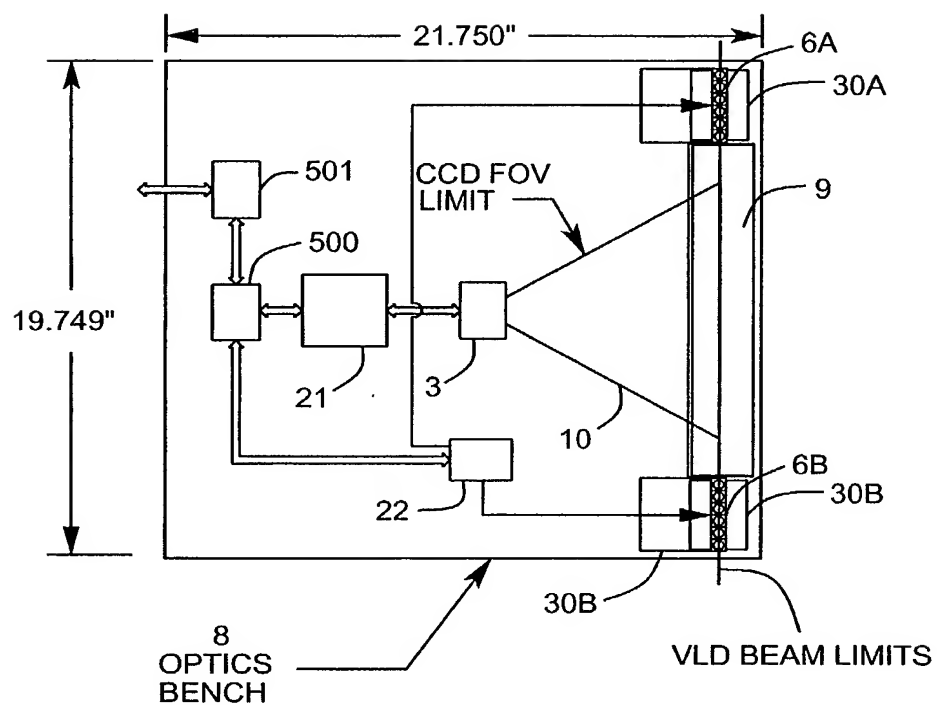


FIG. 1G2

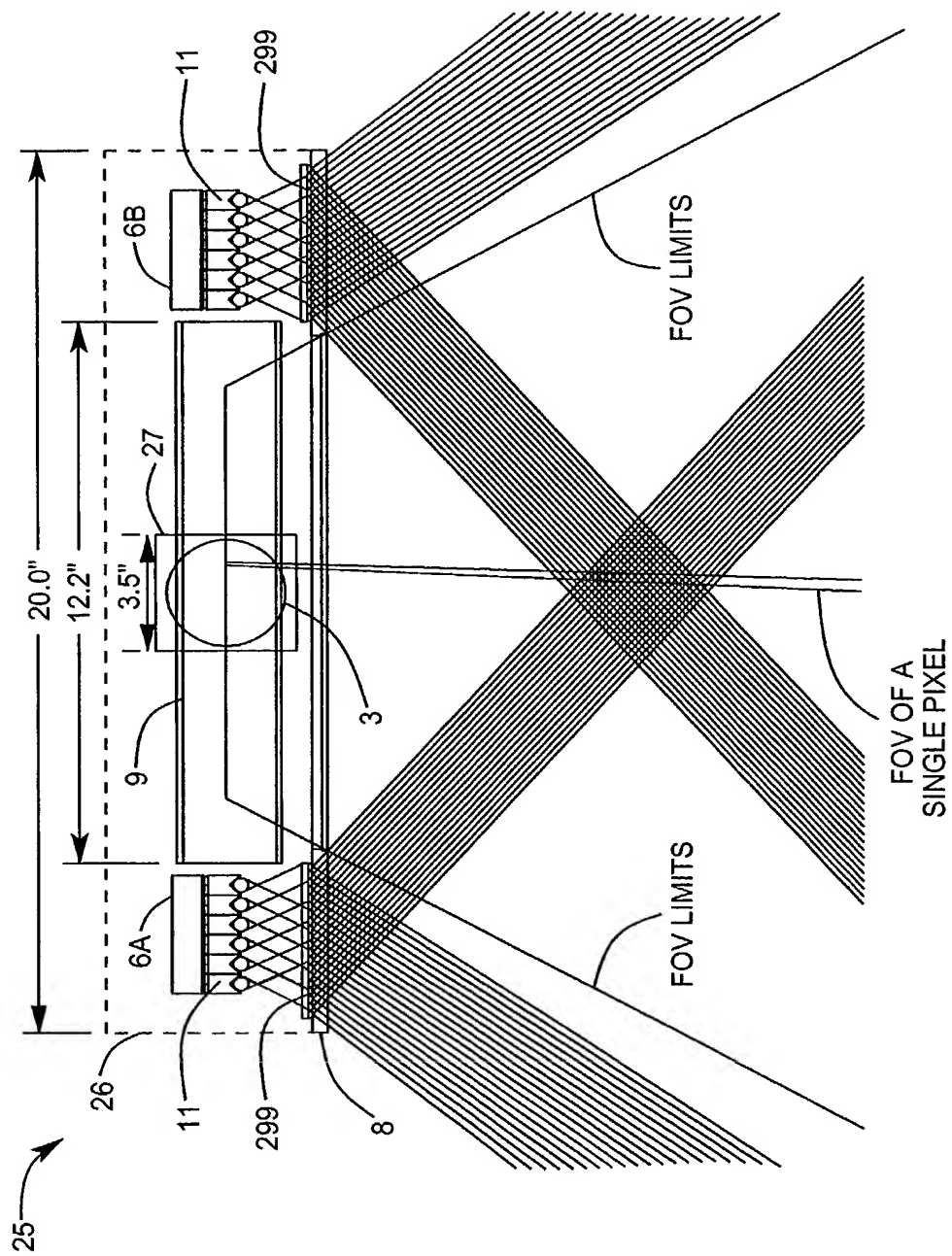


FIG. 1G3

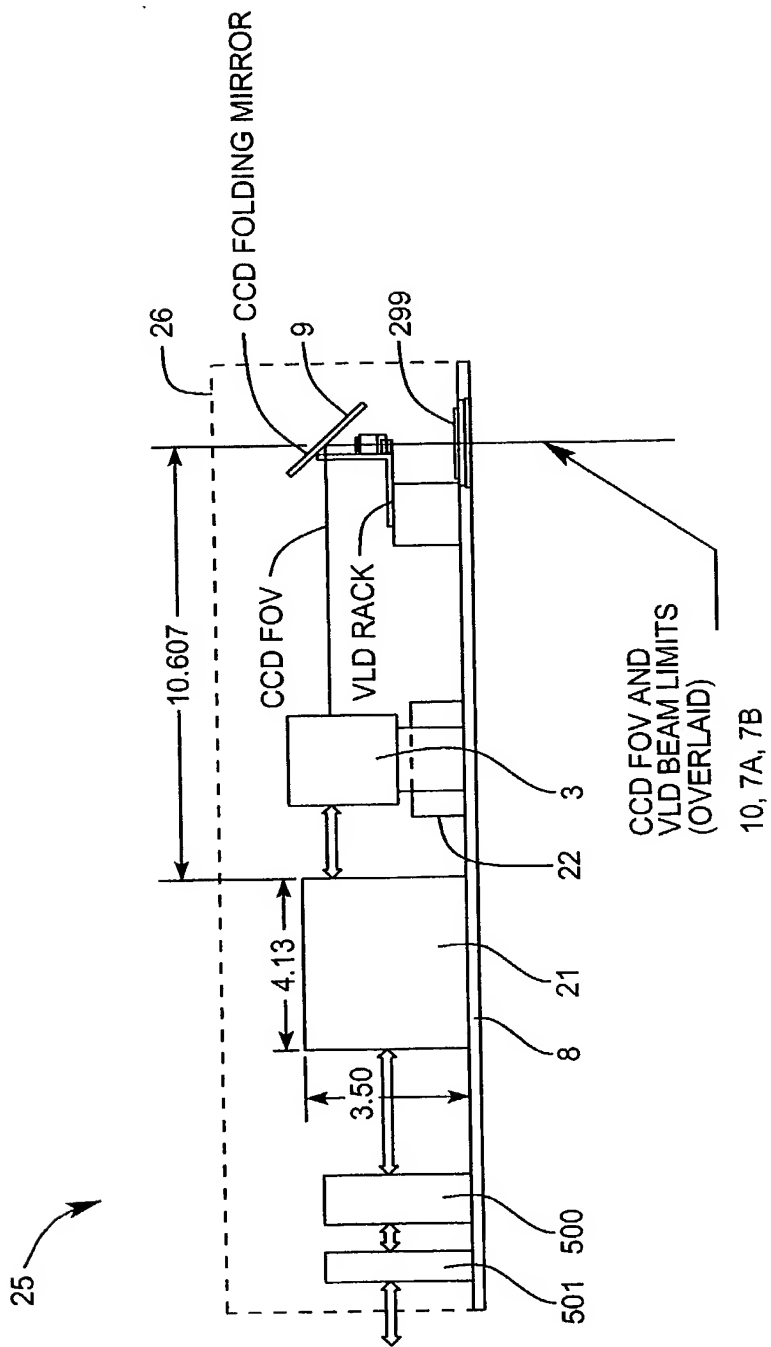


FIG. 1G4

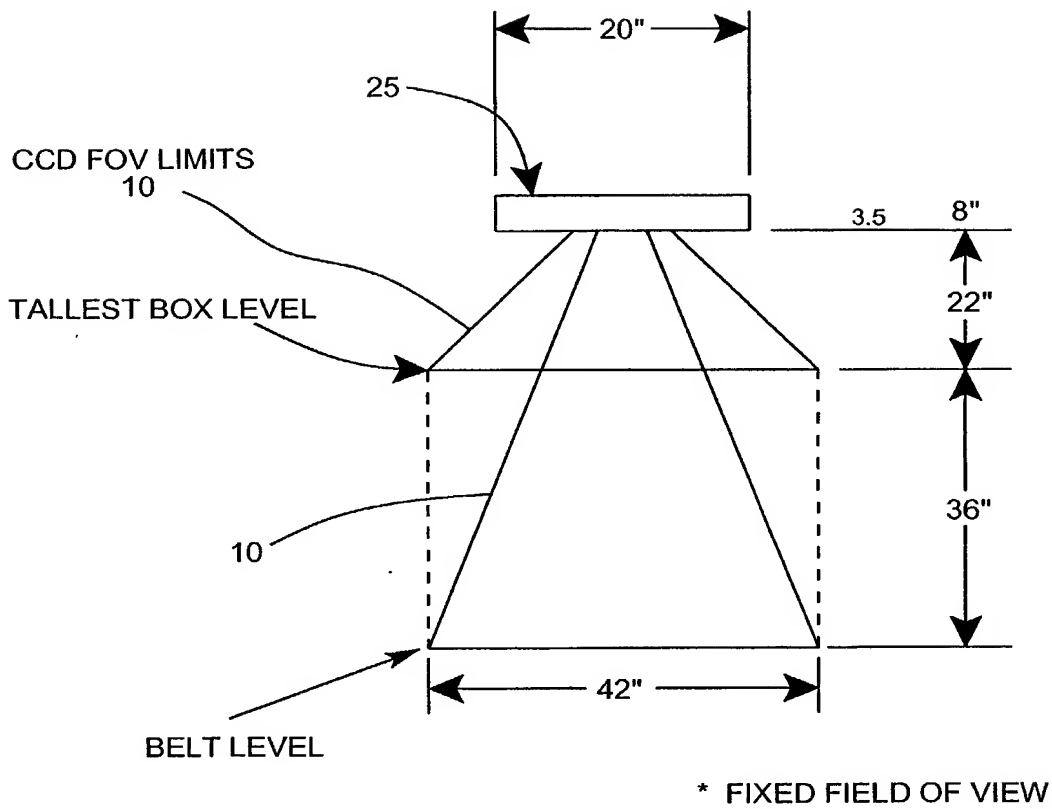


FIG. 1G5

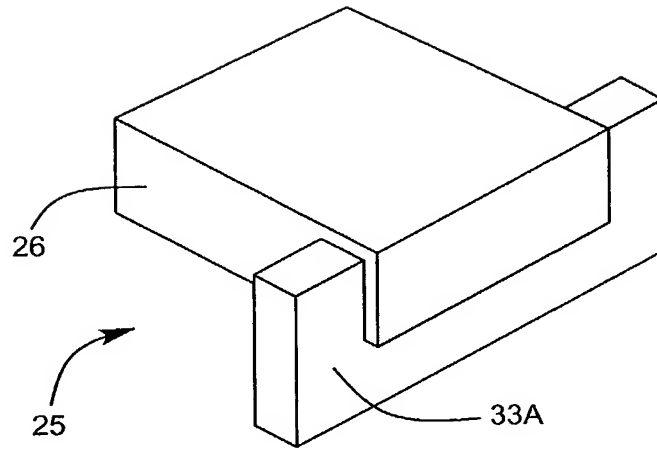


FIG. 1G6

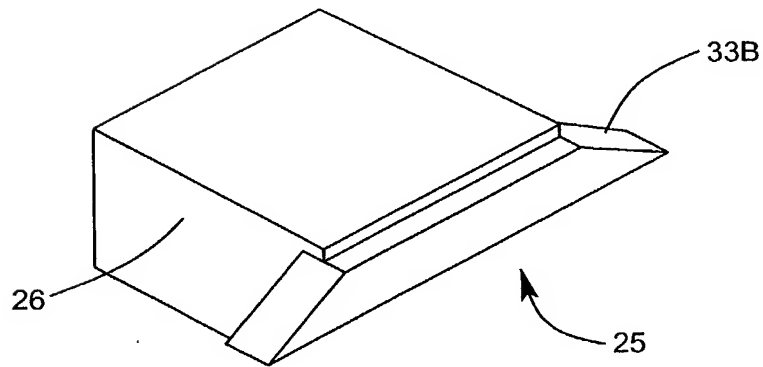
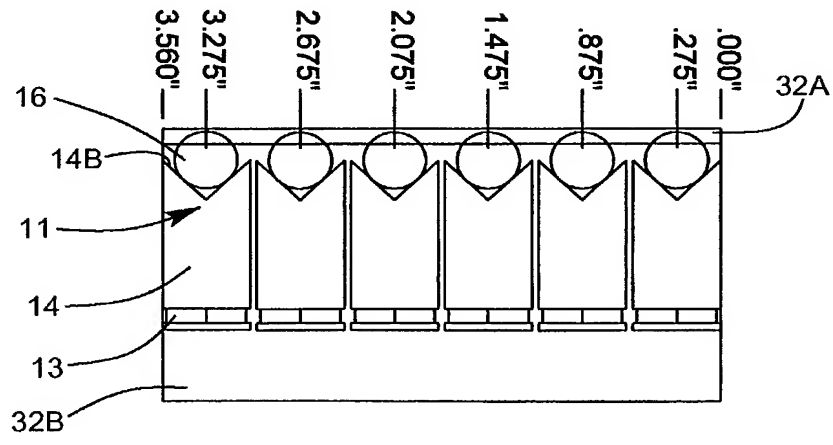
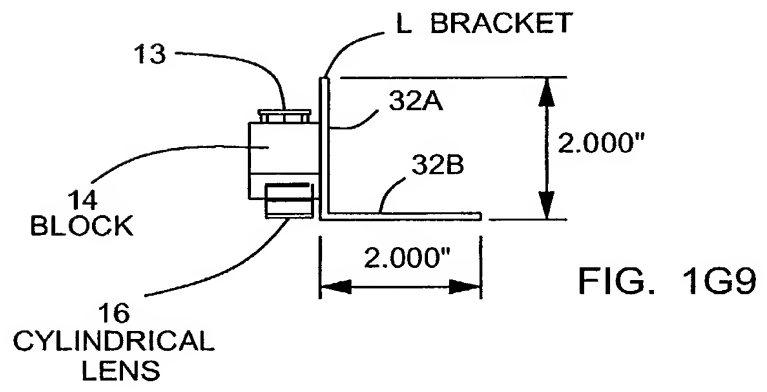
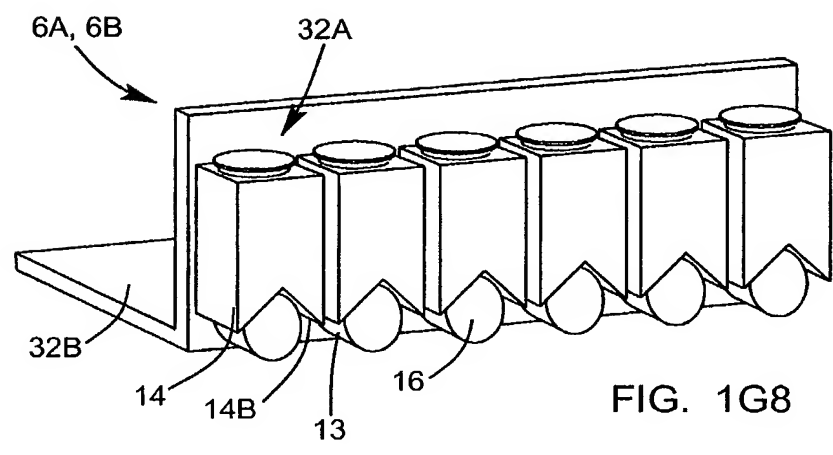


FIG. 1G7





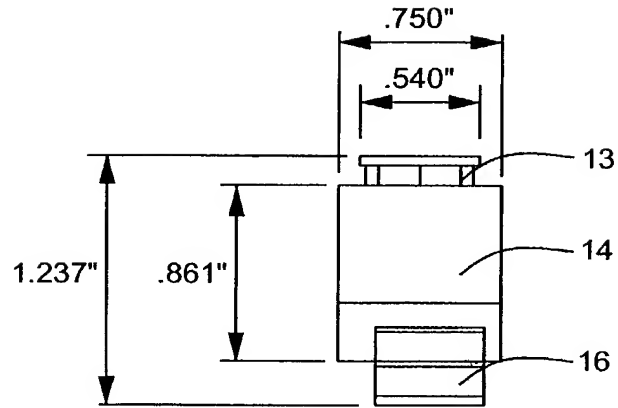


FIG. 1G11

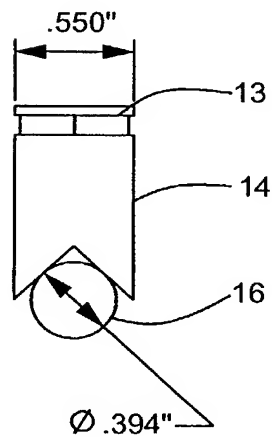


FIG. 1G12

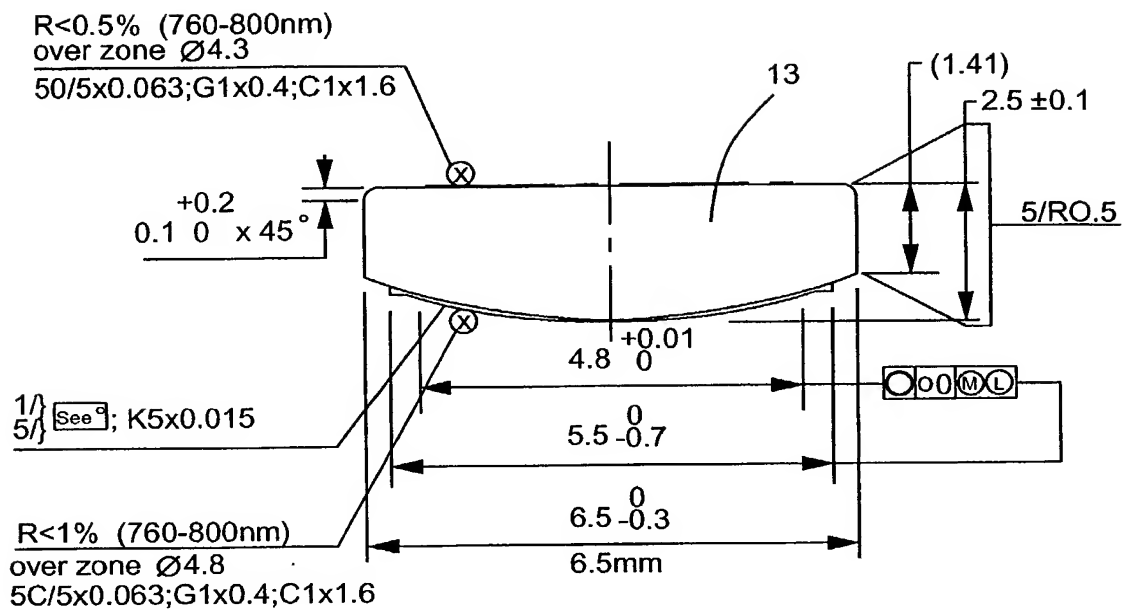


FIG. 1G13

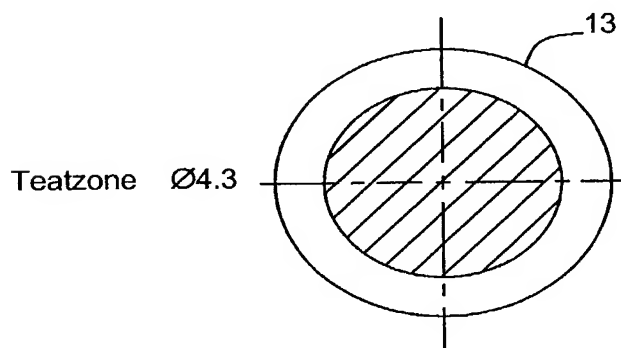


FIG. 1G14

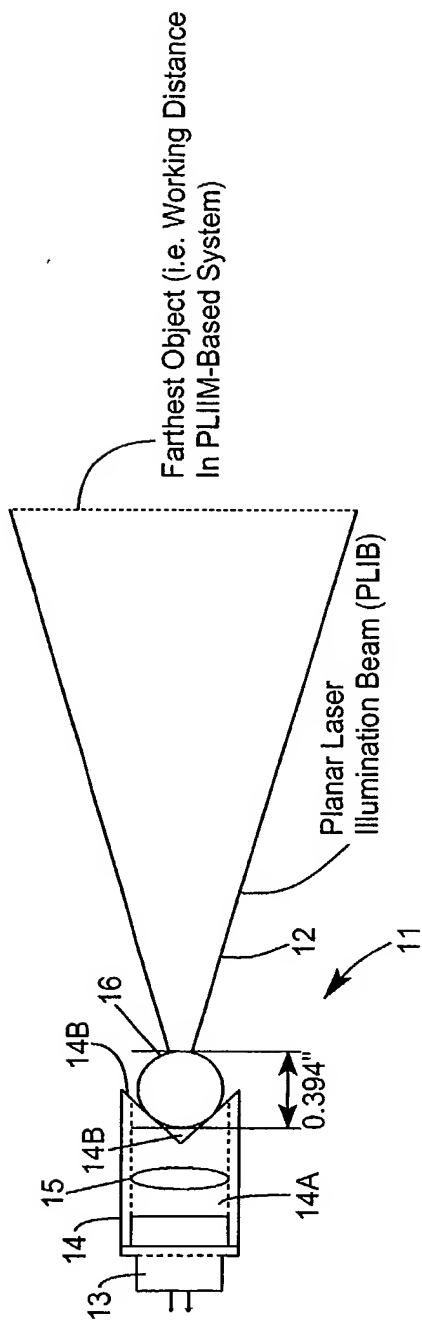


FIG. 1G15A

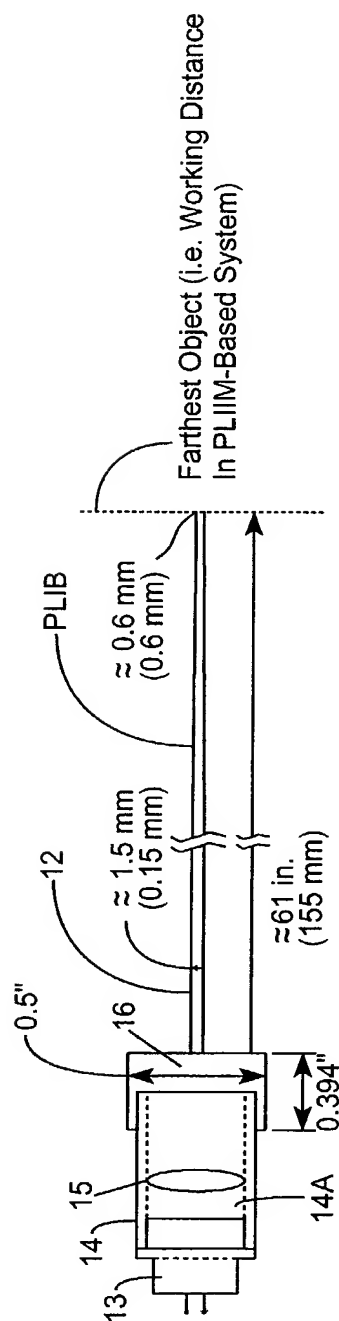


FIG. 1G15B

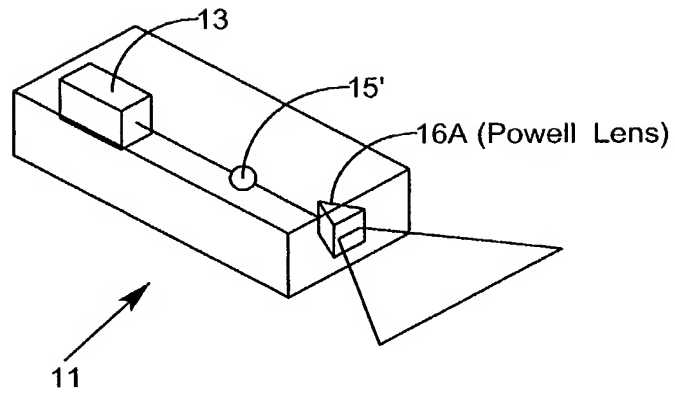


FIG. 1G16A

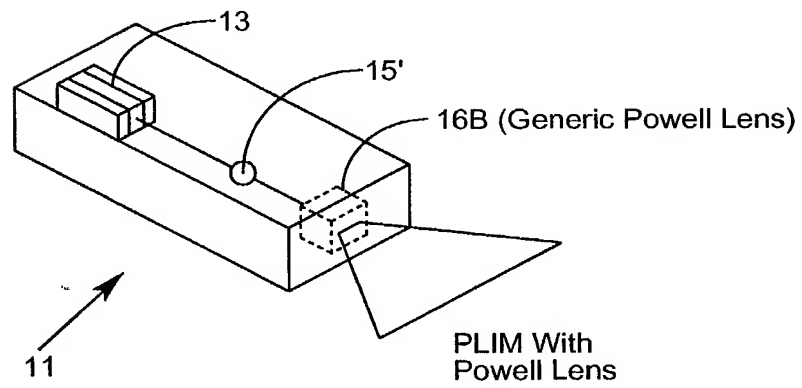


FIG. 1G16B

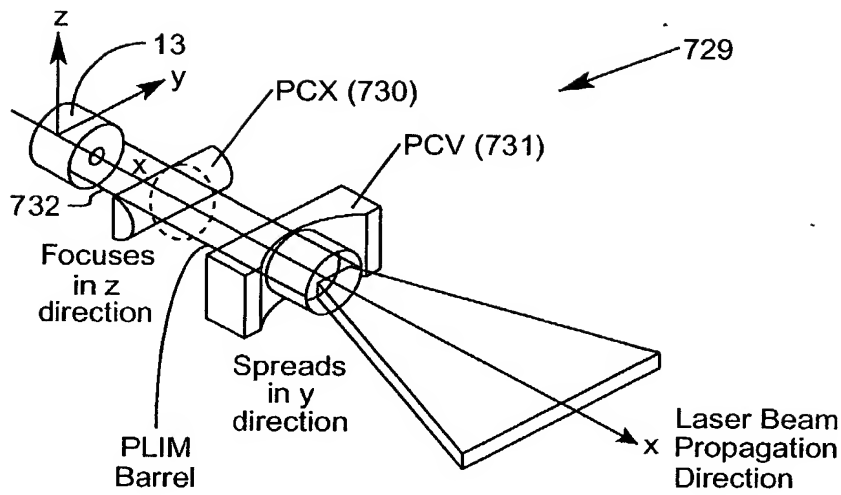


FIG. 1G17A

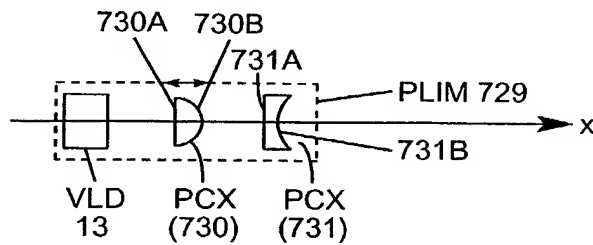


FIG. 1G17B

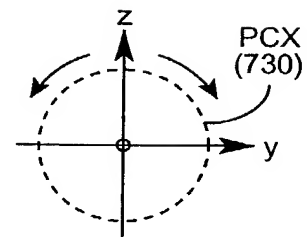


FIG. 1G17C

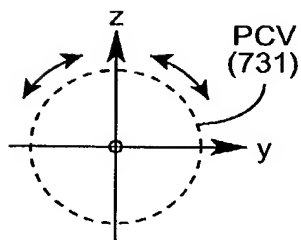


FIG. 1G17D

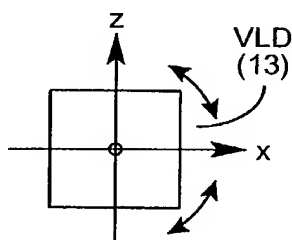


FIG. 1G17E

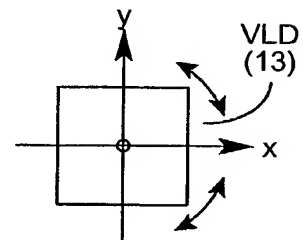


FIG. 1G17F

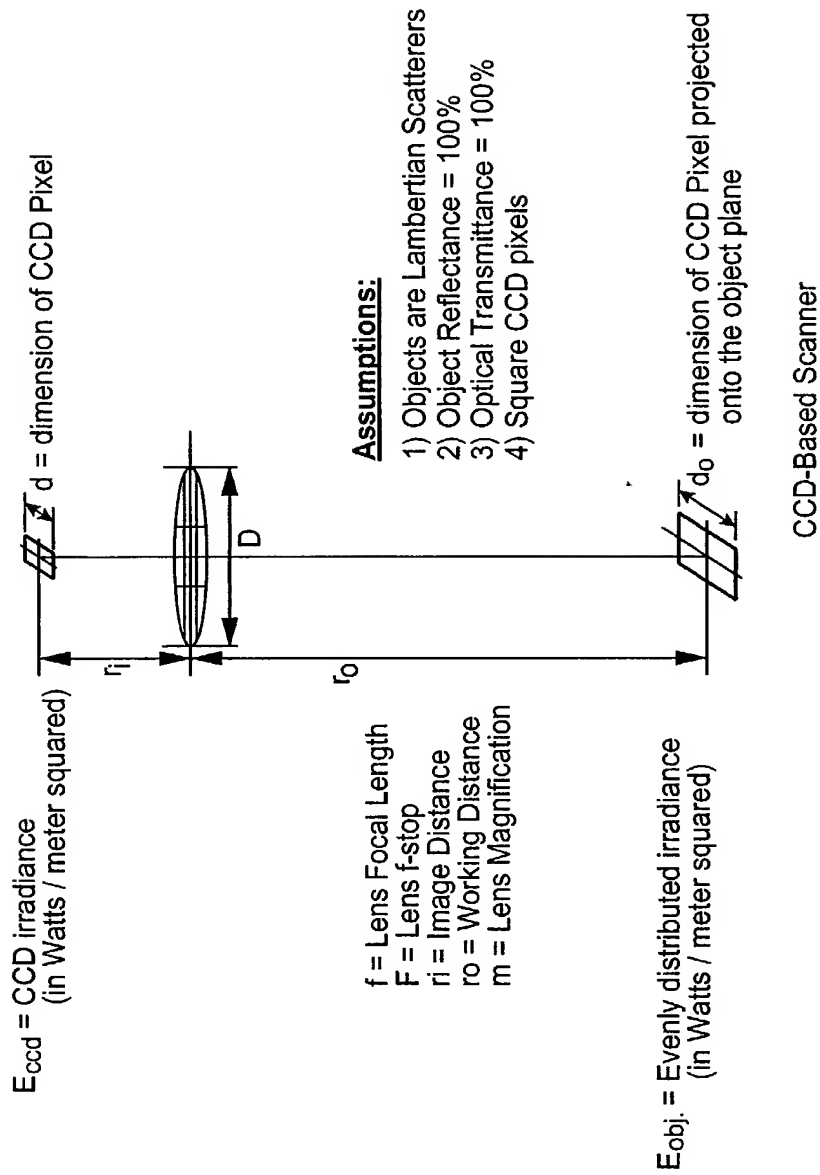


FIG. 1H6

# FIRST GENERALIZED METHOD OF REDUCING SPECKLE-NOISE PATTERNS AT IMAGE DETECTION ARRAY OF THE IFD SUBSYSTEM (3)

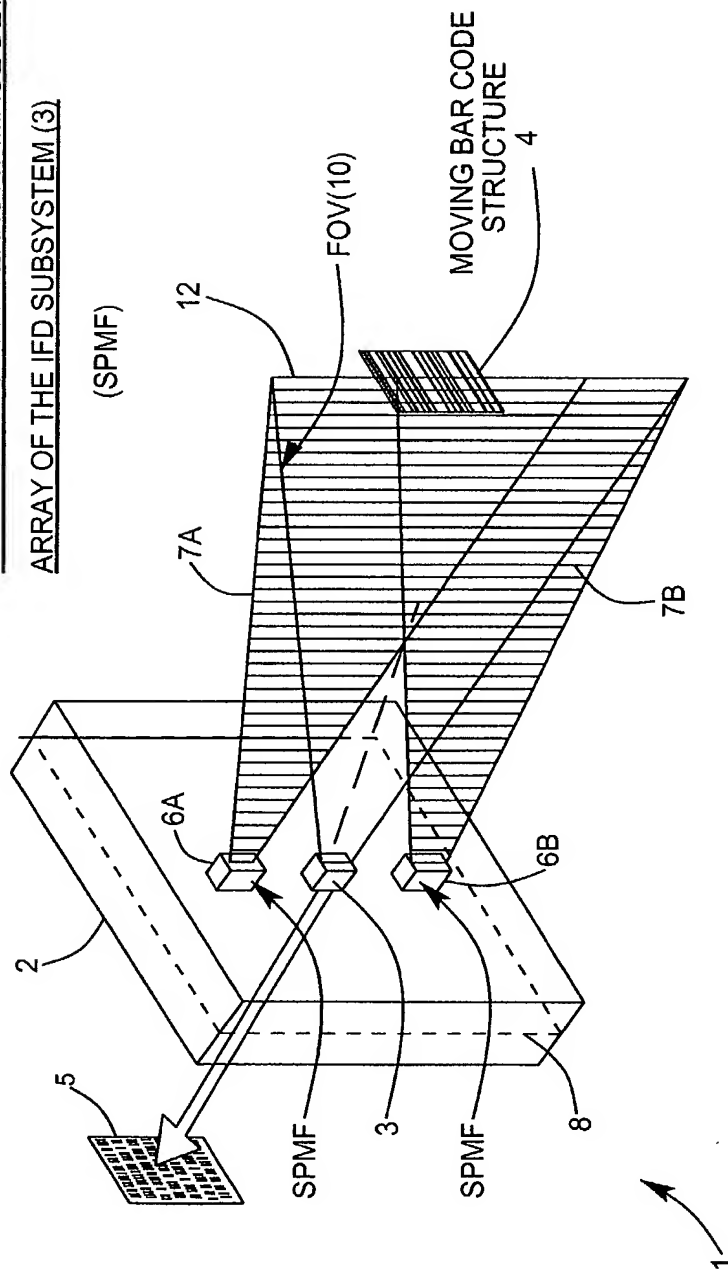


FIG. 111



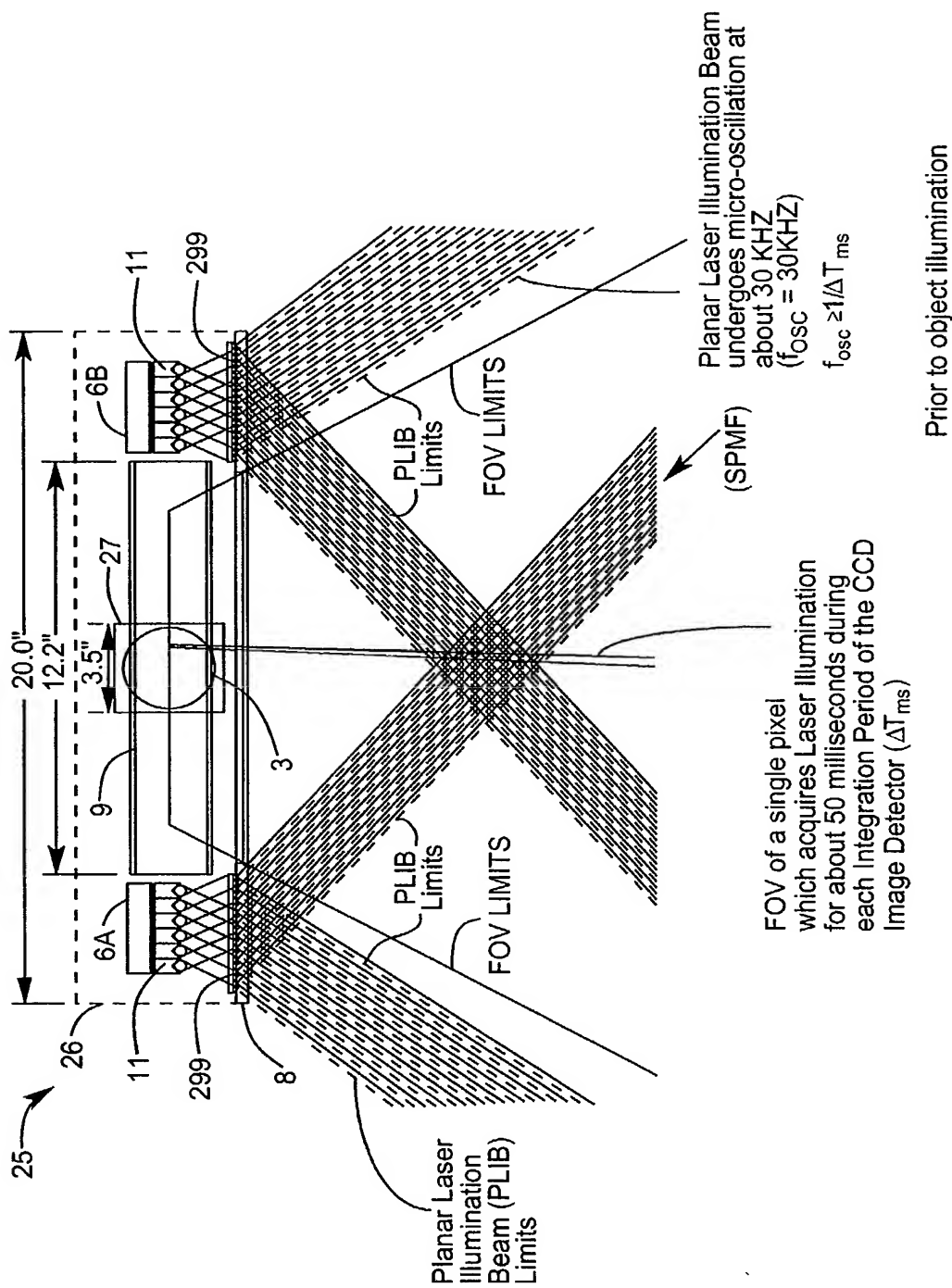


FIG. 112A

THE FIRST GENERALIZED SPECKLE-NOISE PATTERN REDUCTION  
METHOD OF THE PRESENT INVENTION

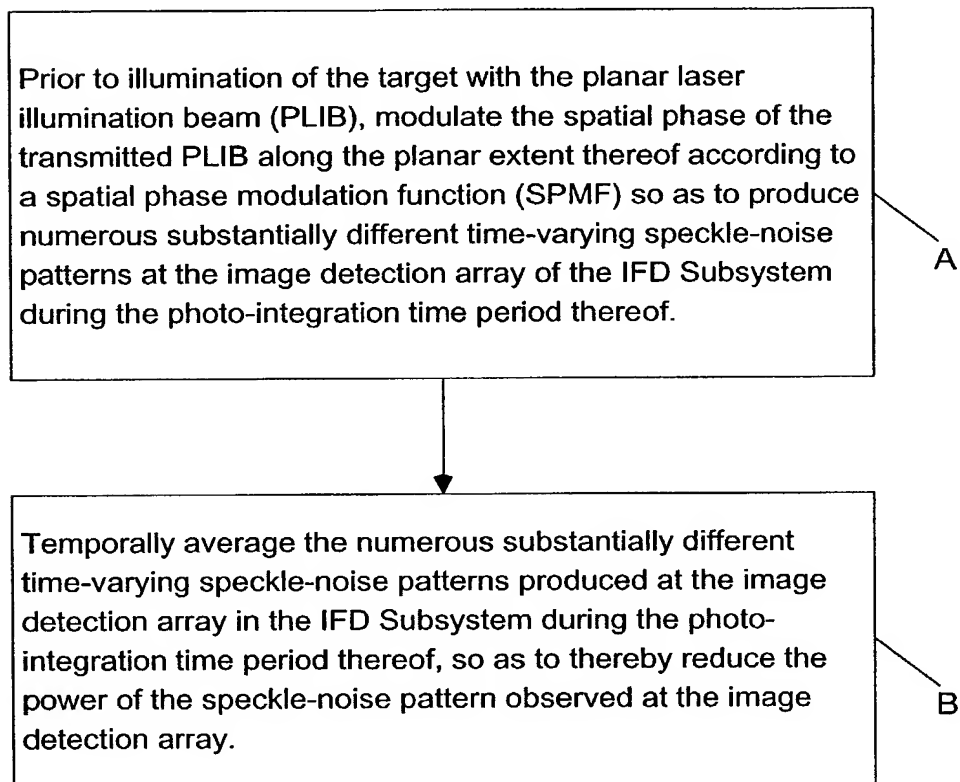
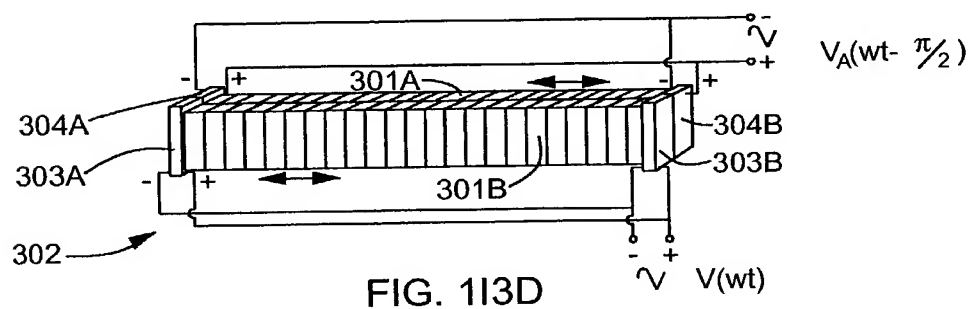
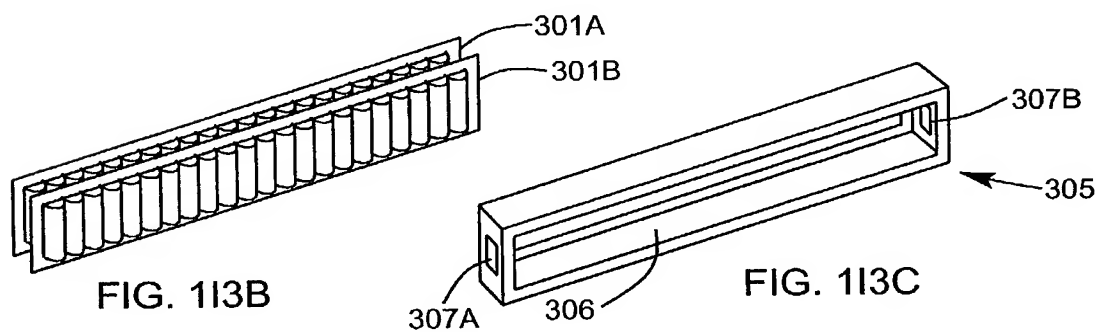
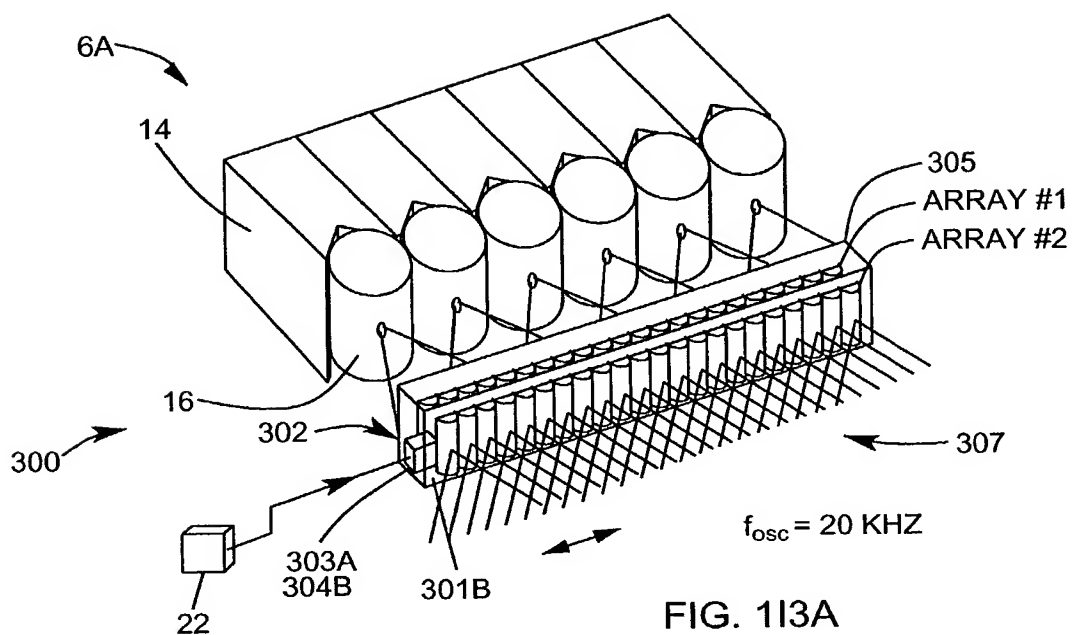
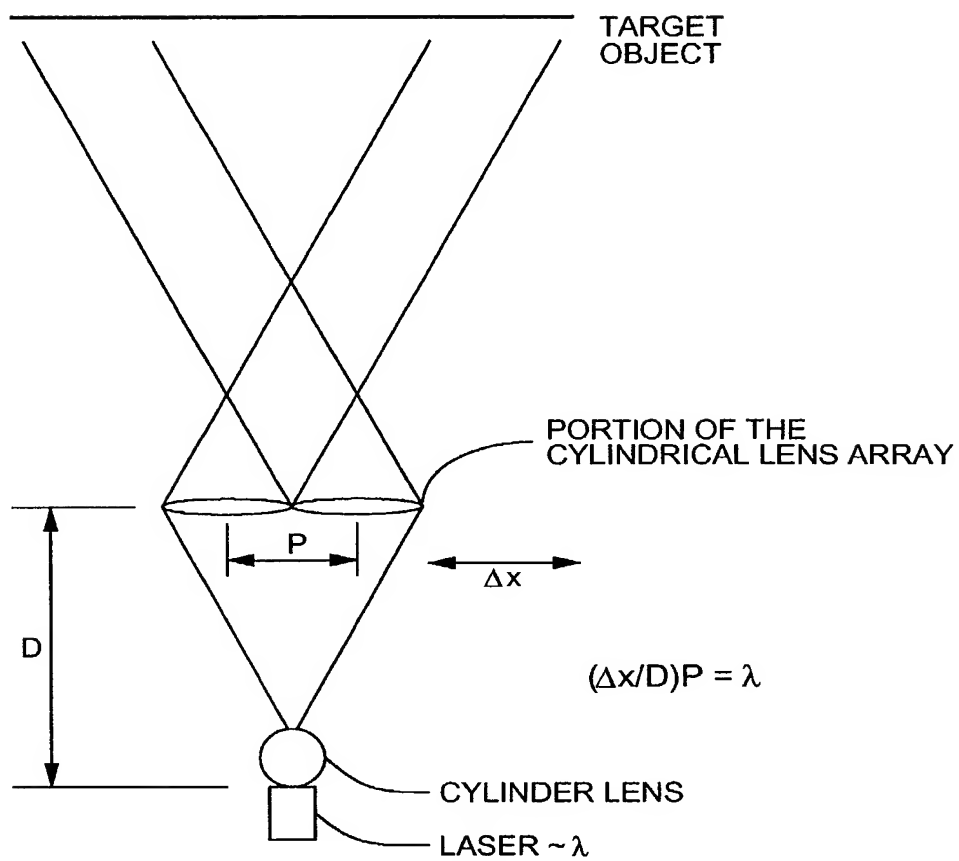


FIG. 112B

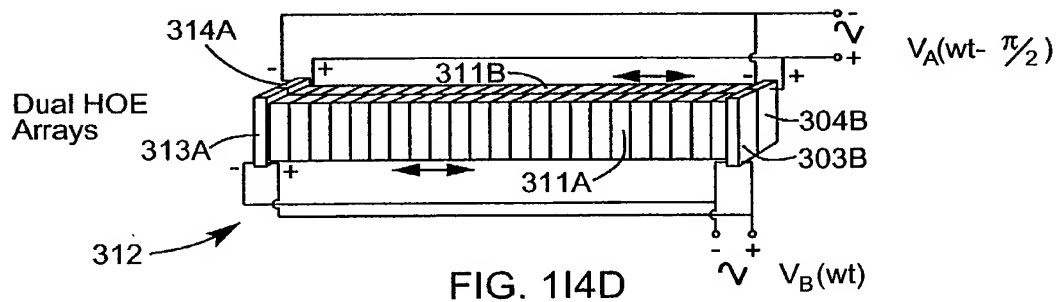
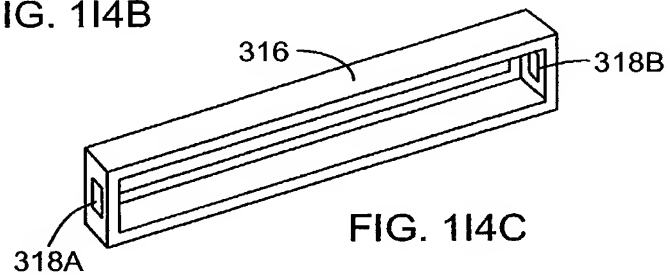
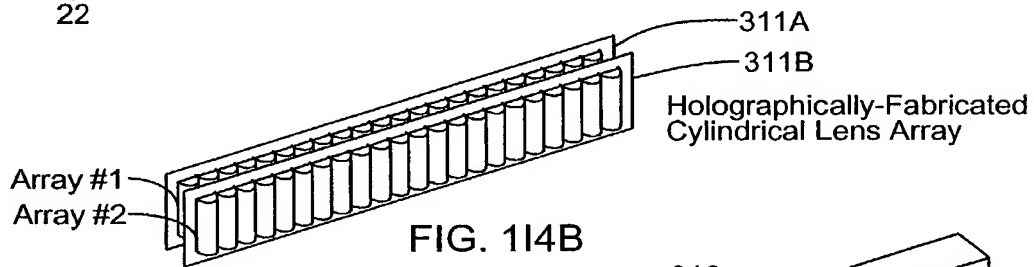
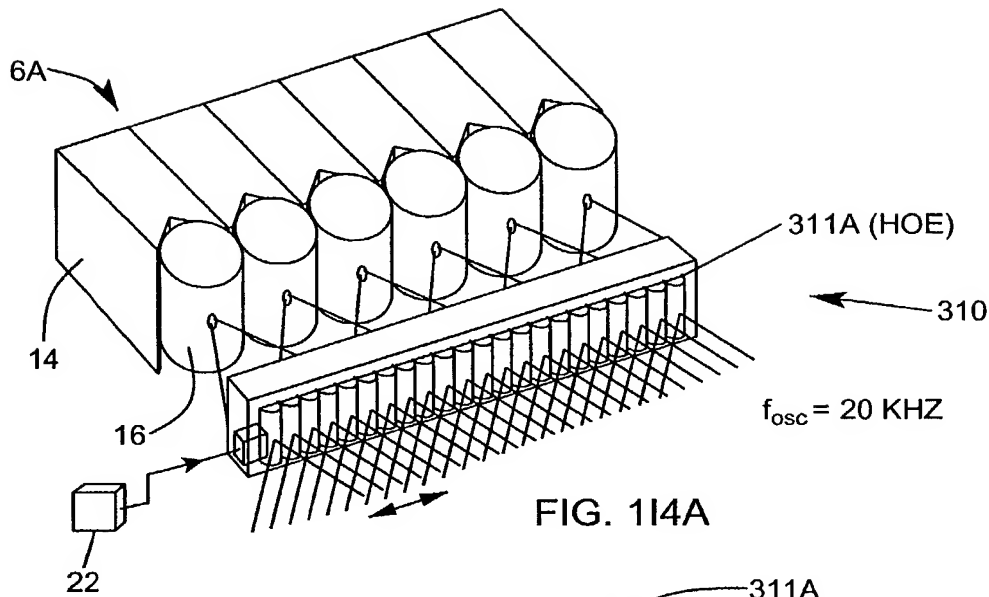




$$\Delta x \geq \frac{\lambda \cdot D}{P}$$

FIG. 113E

FIG. 113G



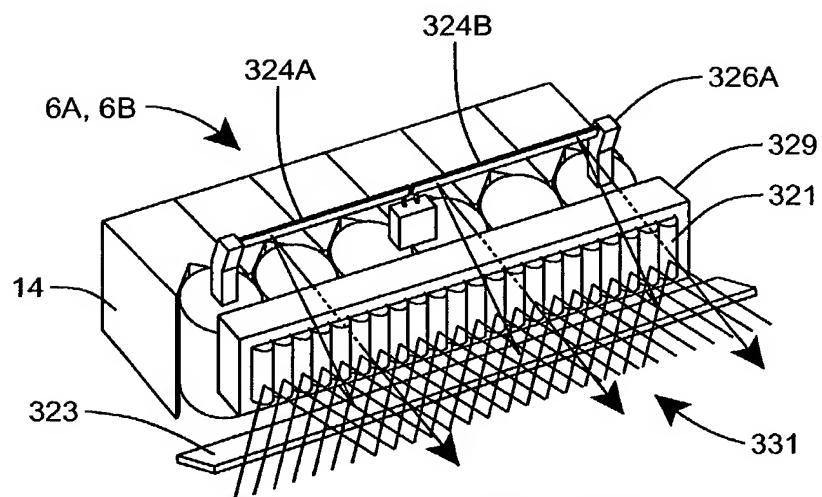


FIG. 115A

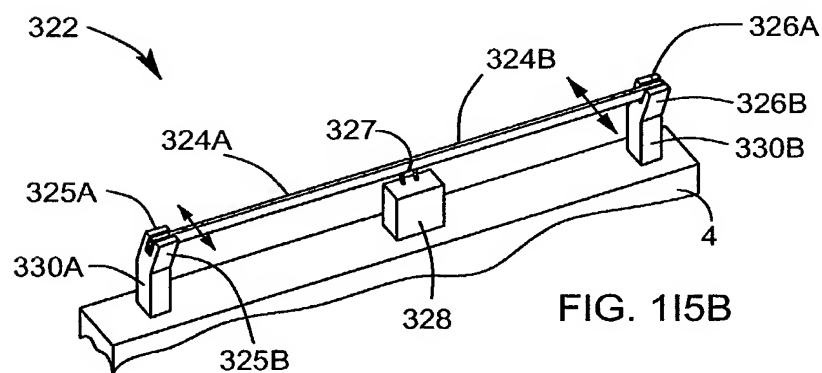


FIG. 115B

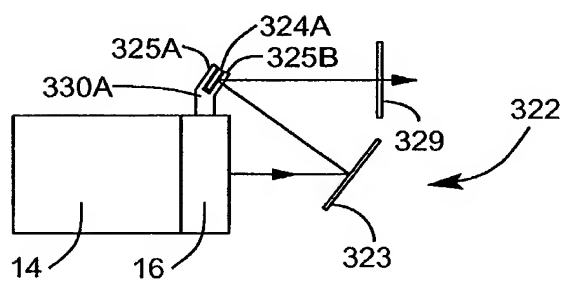


FIG. 115C

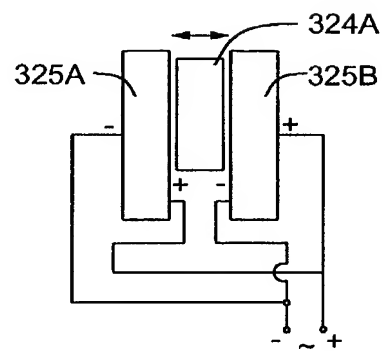
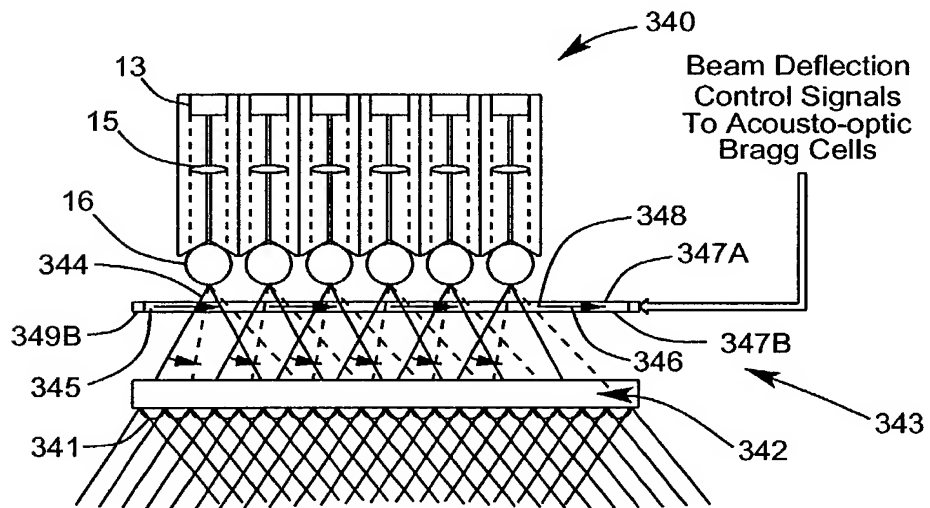
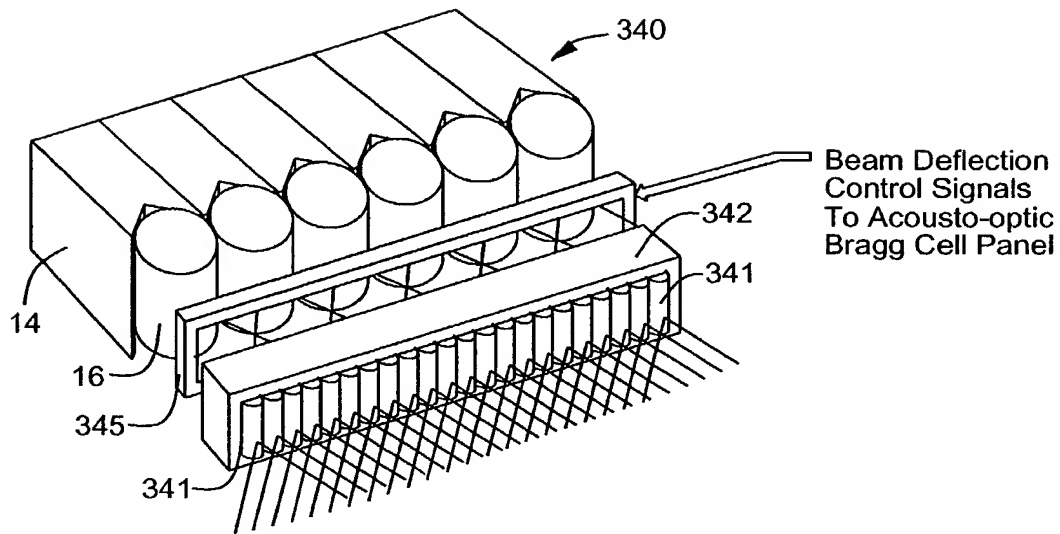
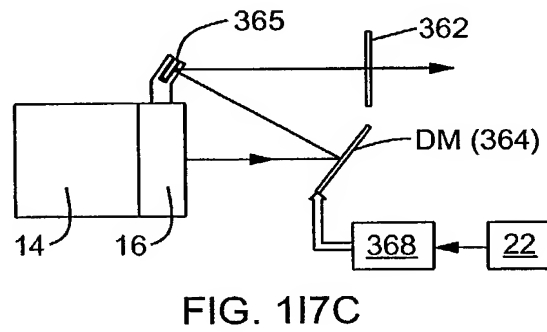
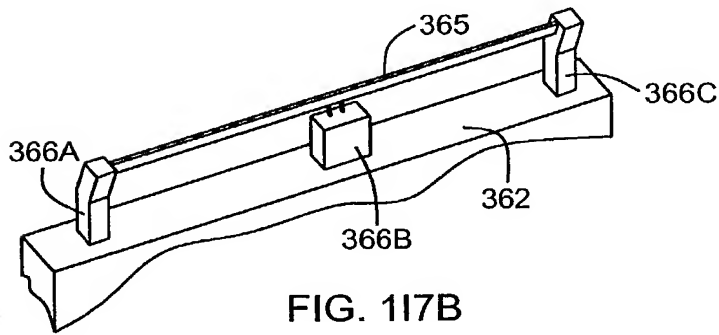
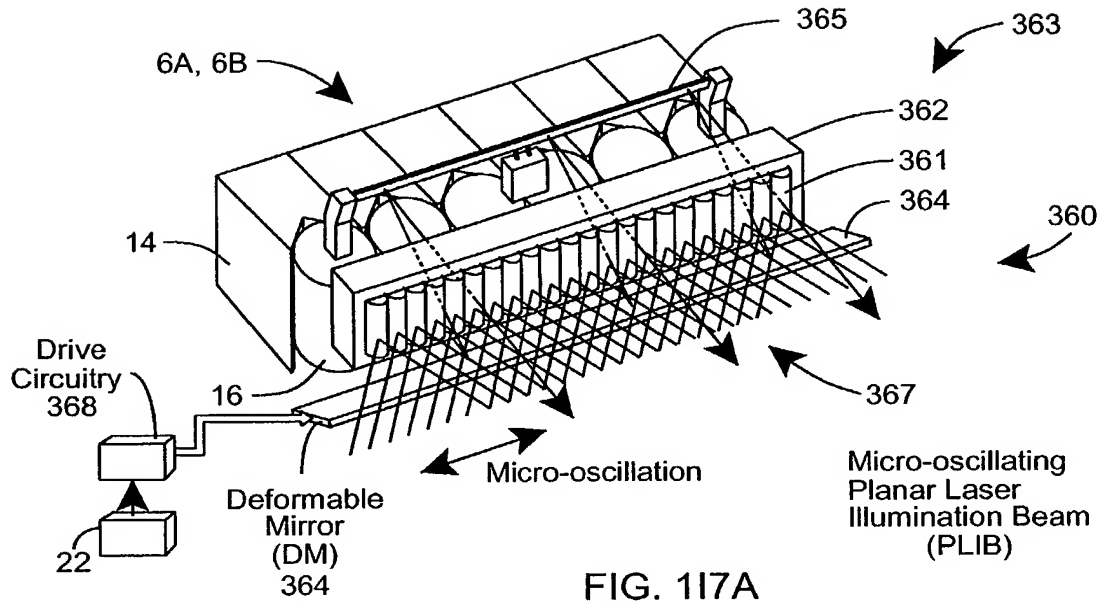


FIG. 115D







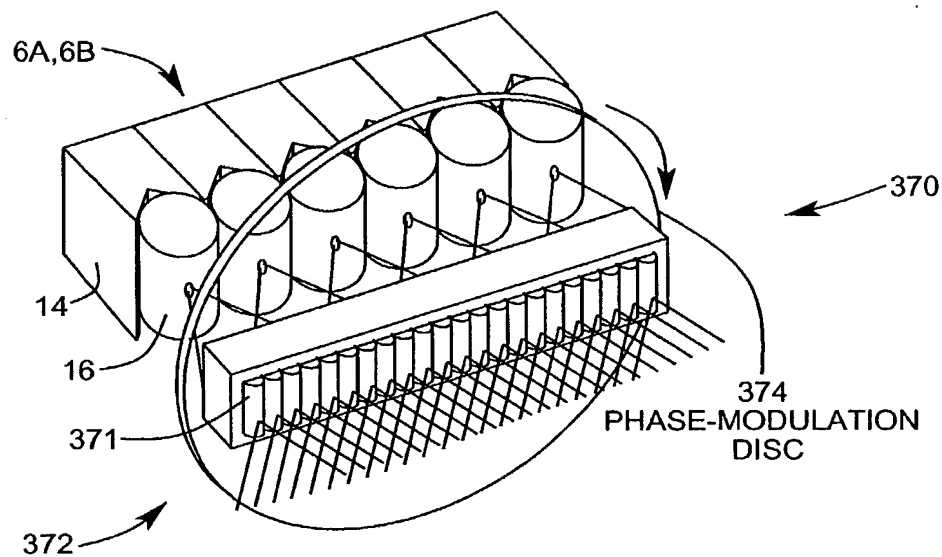


FIG. 118A

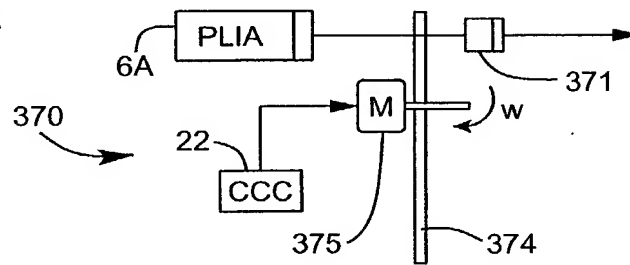


FIG. 118B

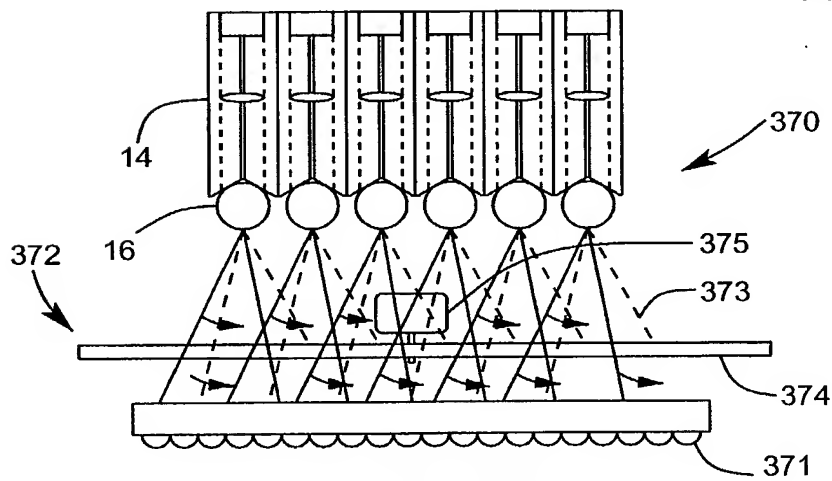


FIG. 118C

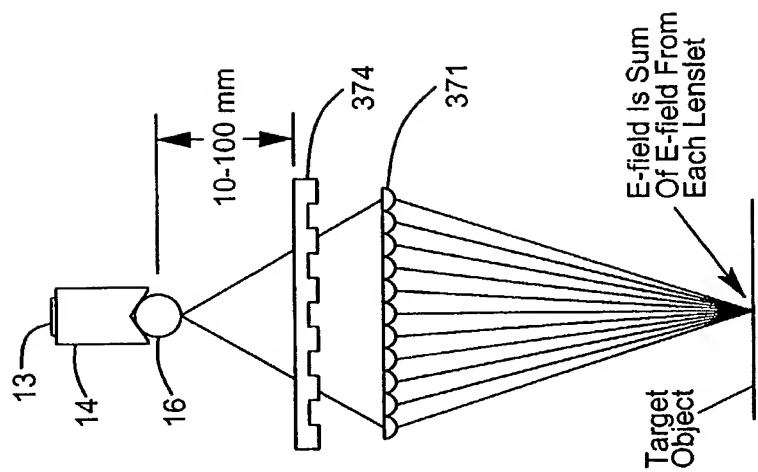


FIG. 118E

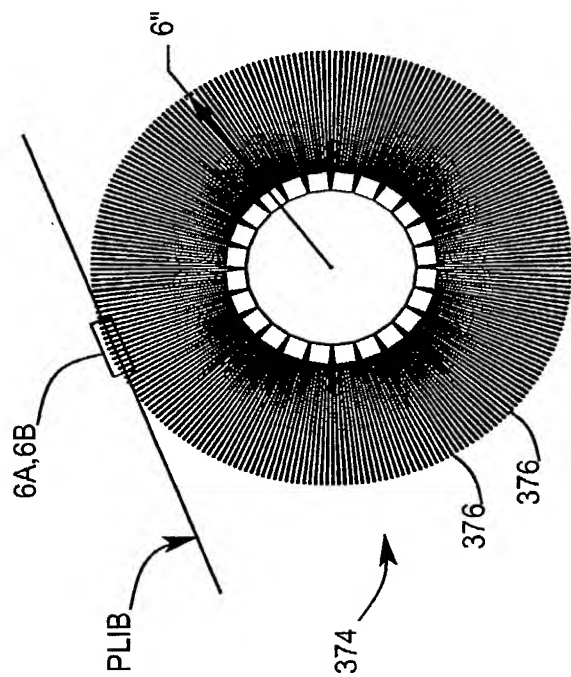


FIG. 118D

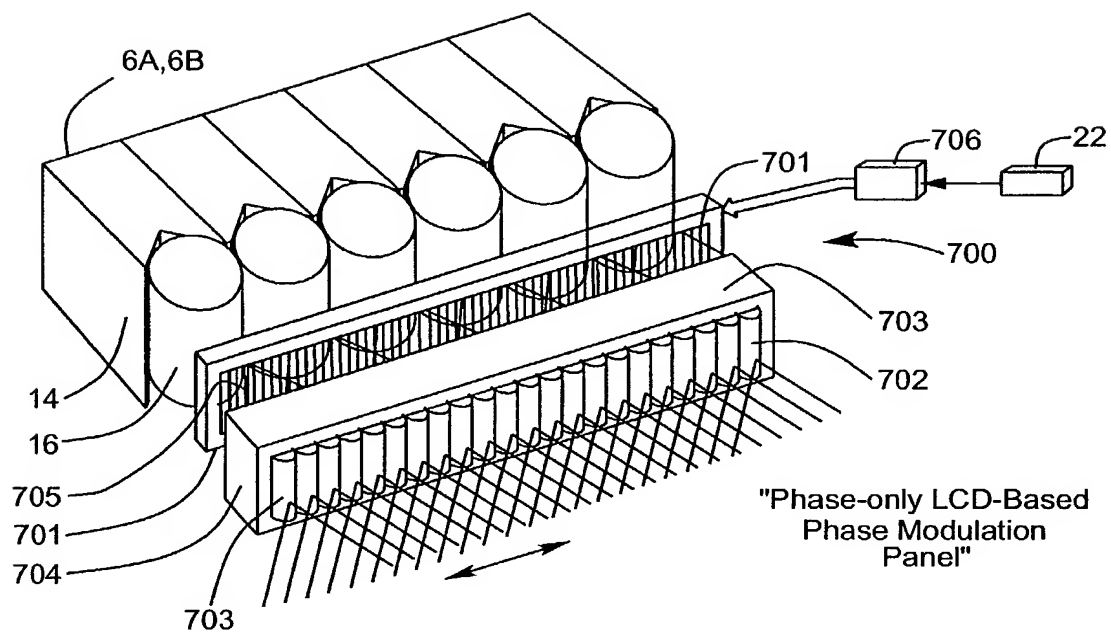


FIG. 118F

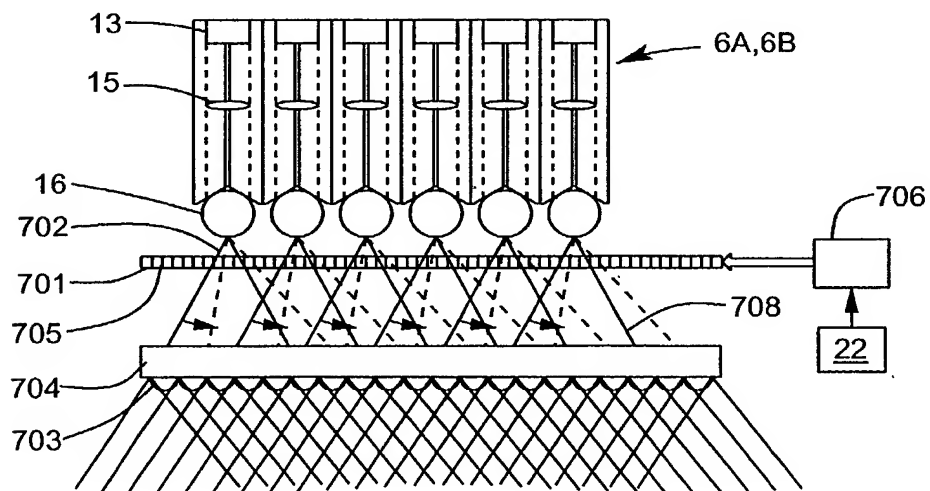


FIG. 118G

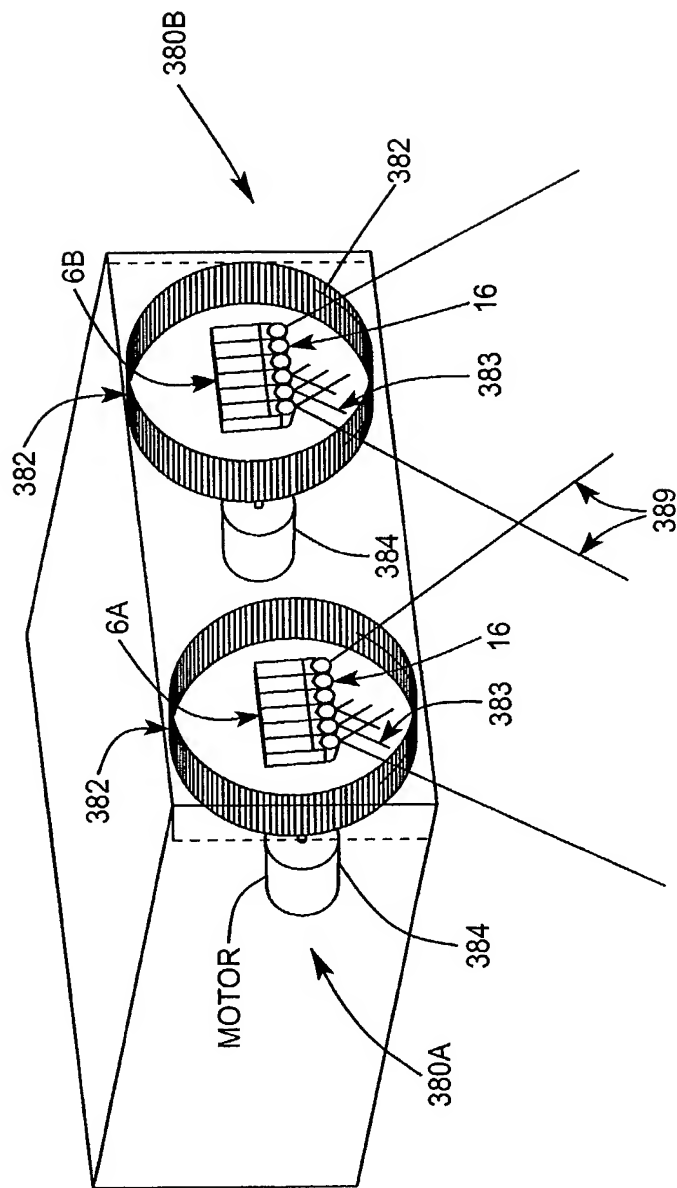
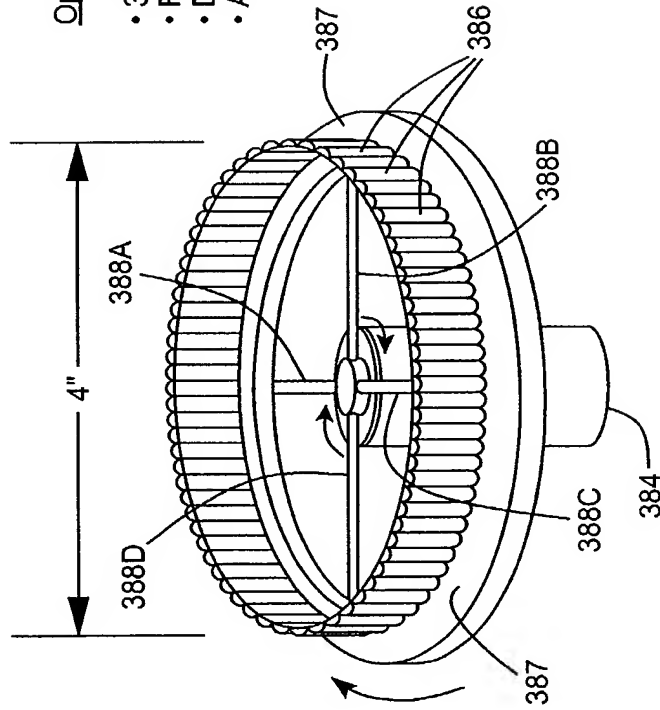


FIG. 119A



Optical Specifications:

- 30 Cylindrical Lens (Lines) Per Linear Inch
- Focal Length  $\approx 20$  Millimeters
- Diameter Of Lenticular Carousel  $\approx 4$  Inches
- Acrylic Material

FIG. 119B

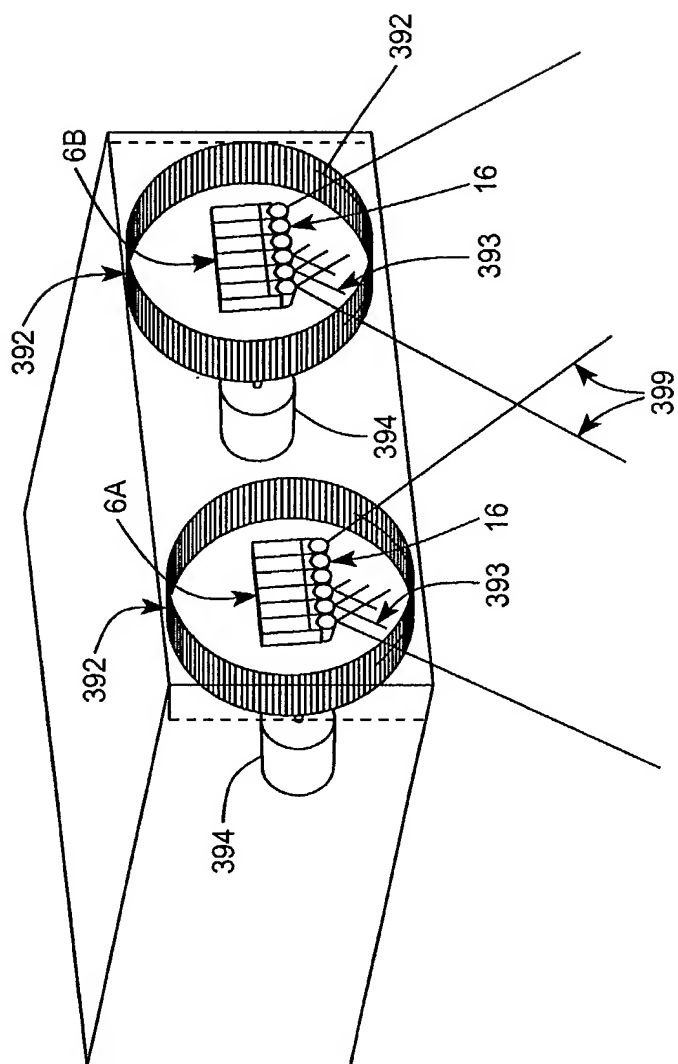


FIG. 1110A

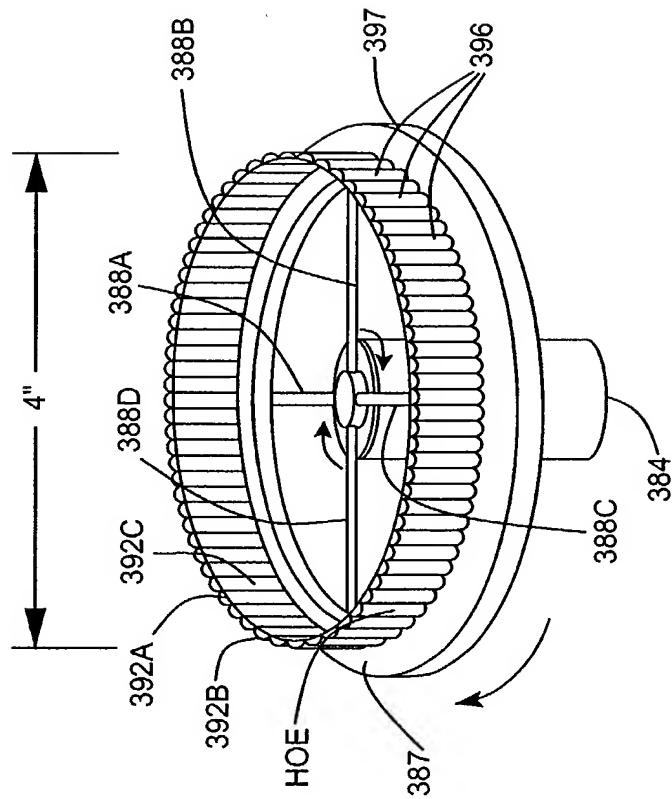


FIG. 110B

Optical Specifications:

- 30 Cylindrical Lens (Lines) Per Linear Inch
- Focal Length  $\approx$  20 Millimeters
- Diameter Of Lenticular Carousel  $\approx$  4 Inches



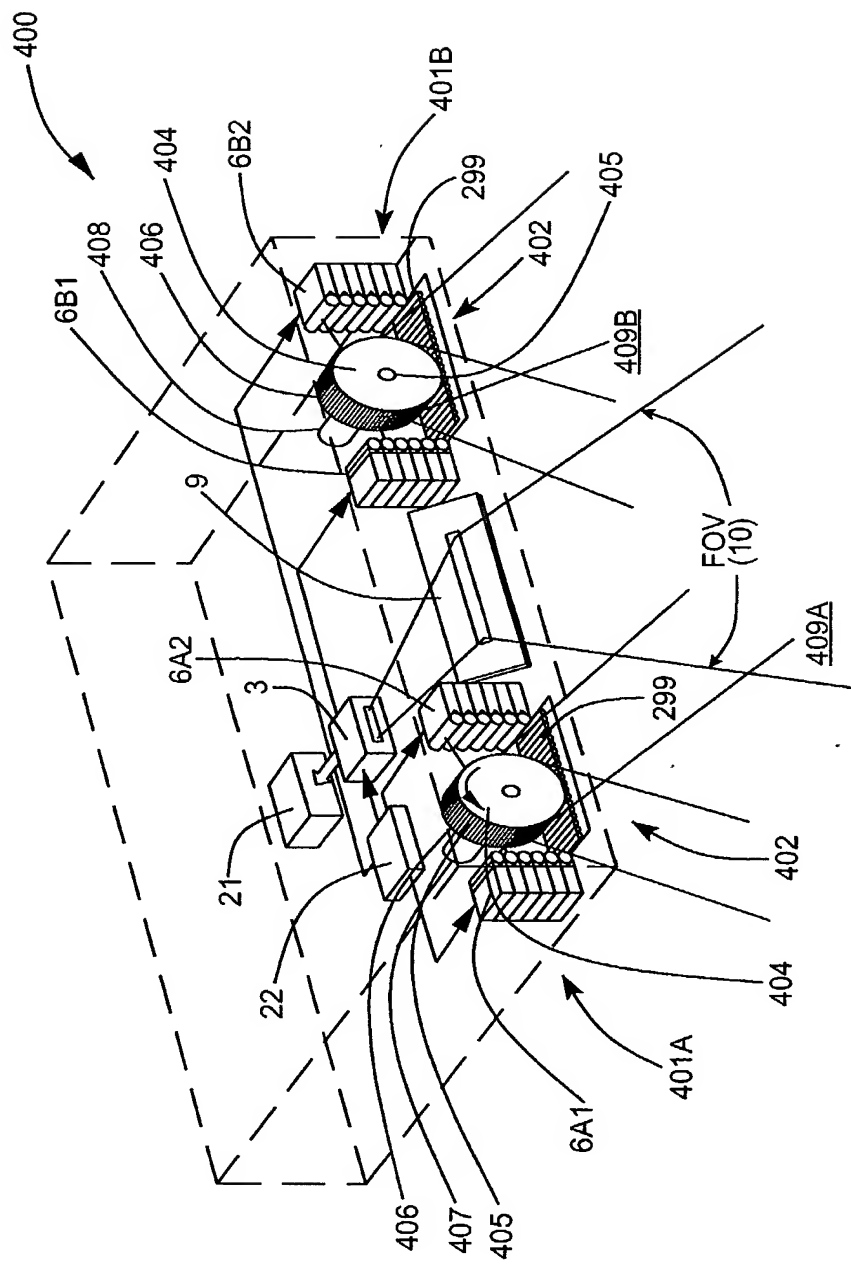


FIG. 1111A

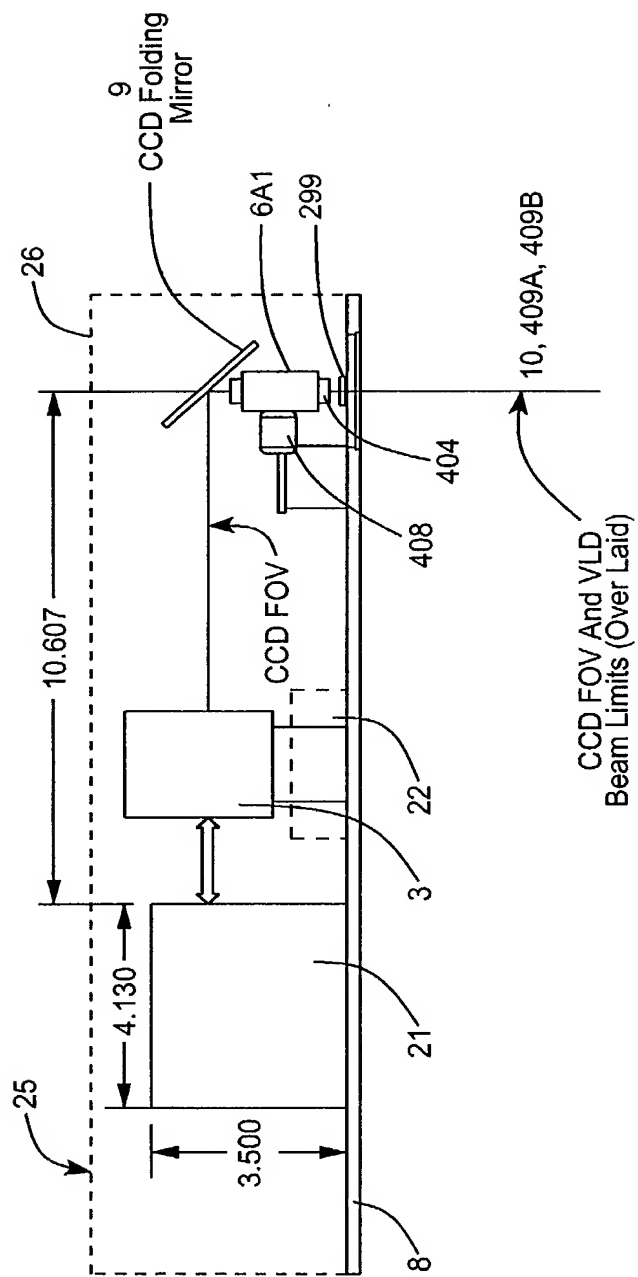


FIG. 1111B

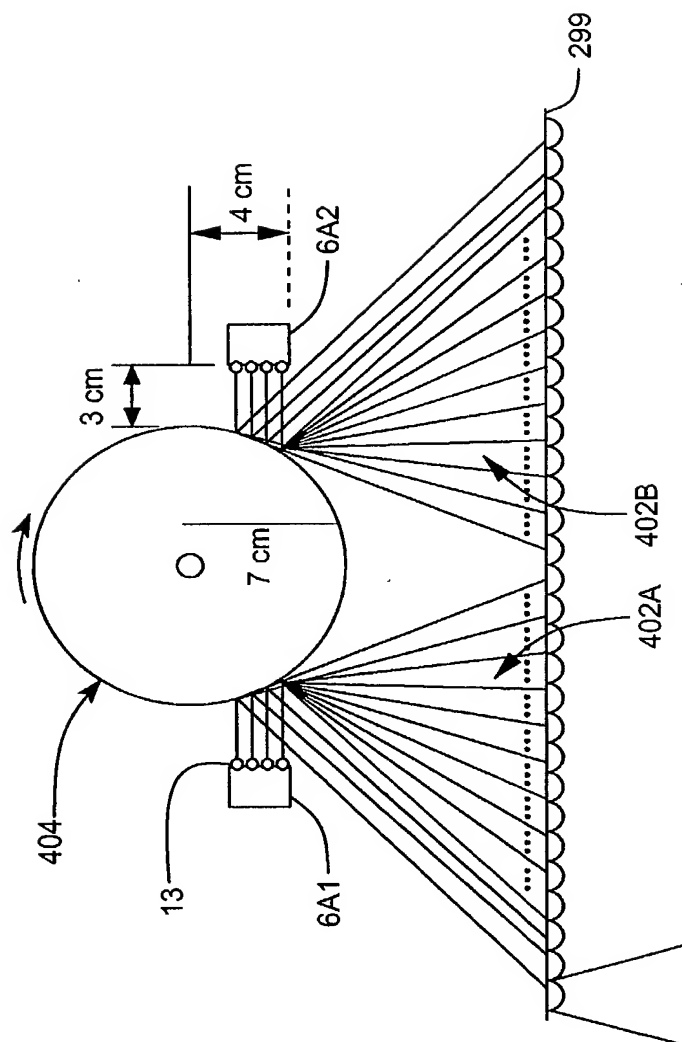


FIG. 1I11C

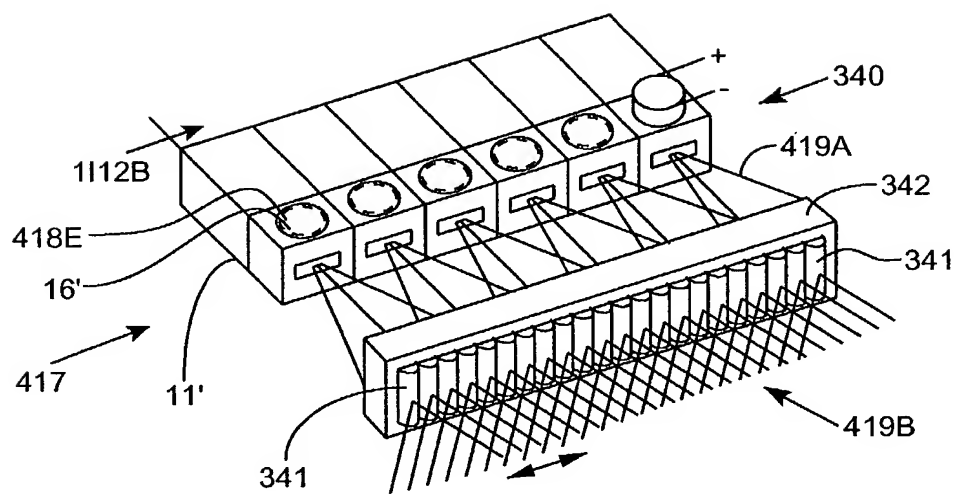


FIG. 1112A

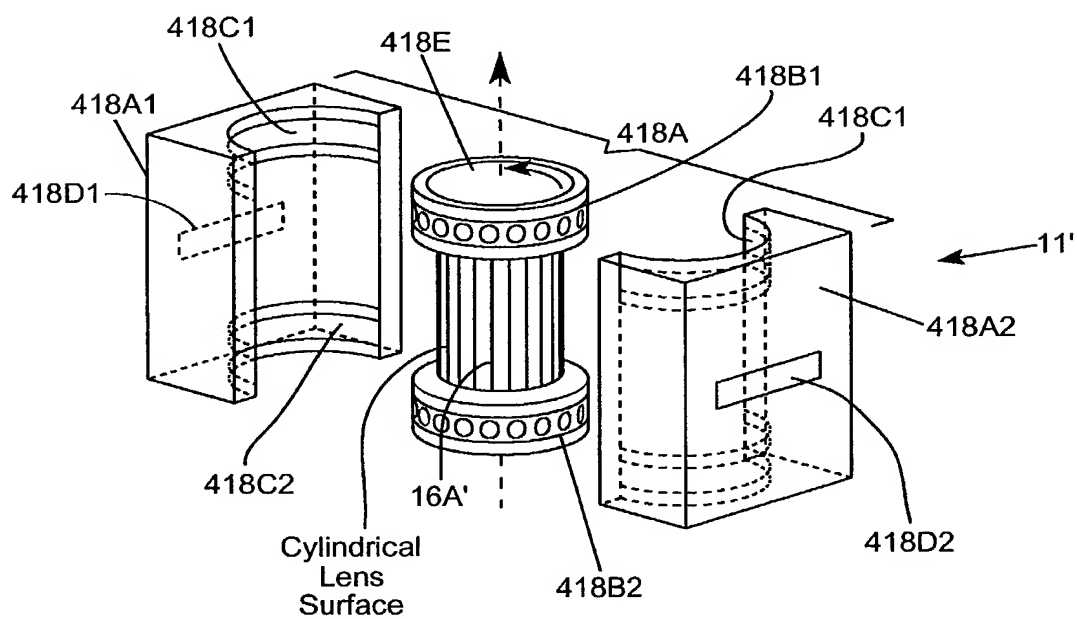


FIG. 1112B

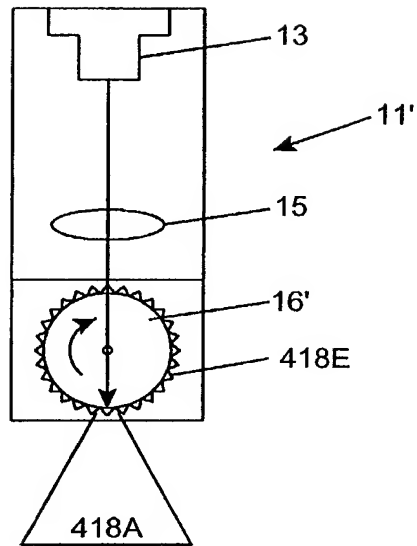


FIG. 1112C

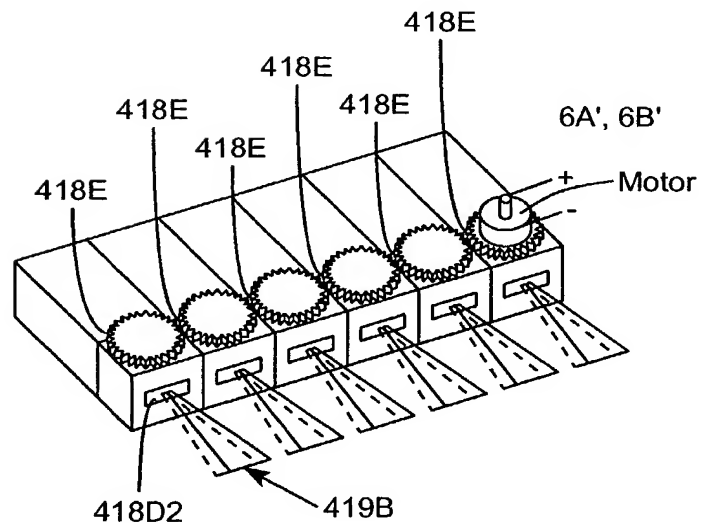


FIG. 1112D

Second Generalized Method Of  
Reducing Speckle-Noise Patterns  
At Image Detection Array  
Of The IFD Subsystem (3).

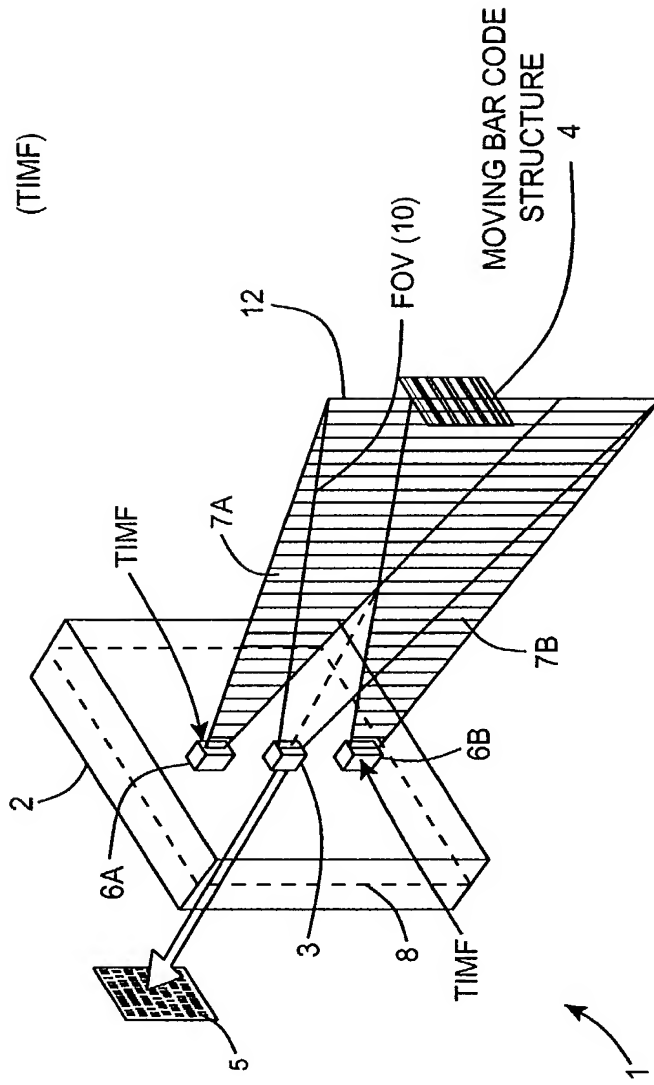


FIG. 1113

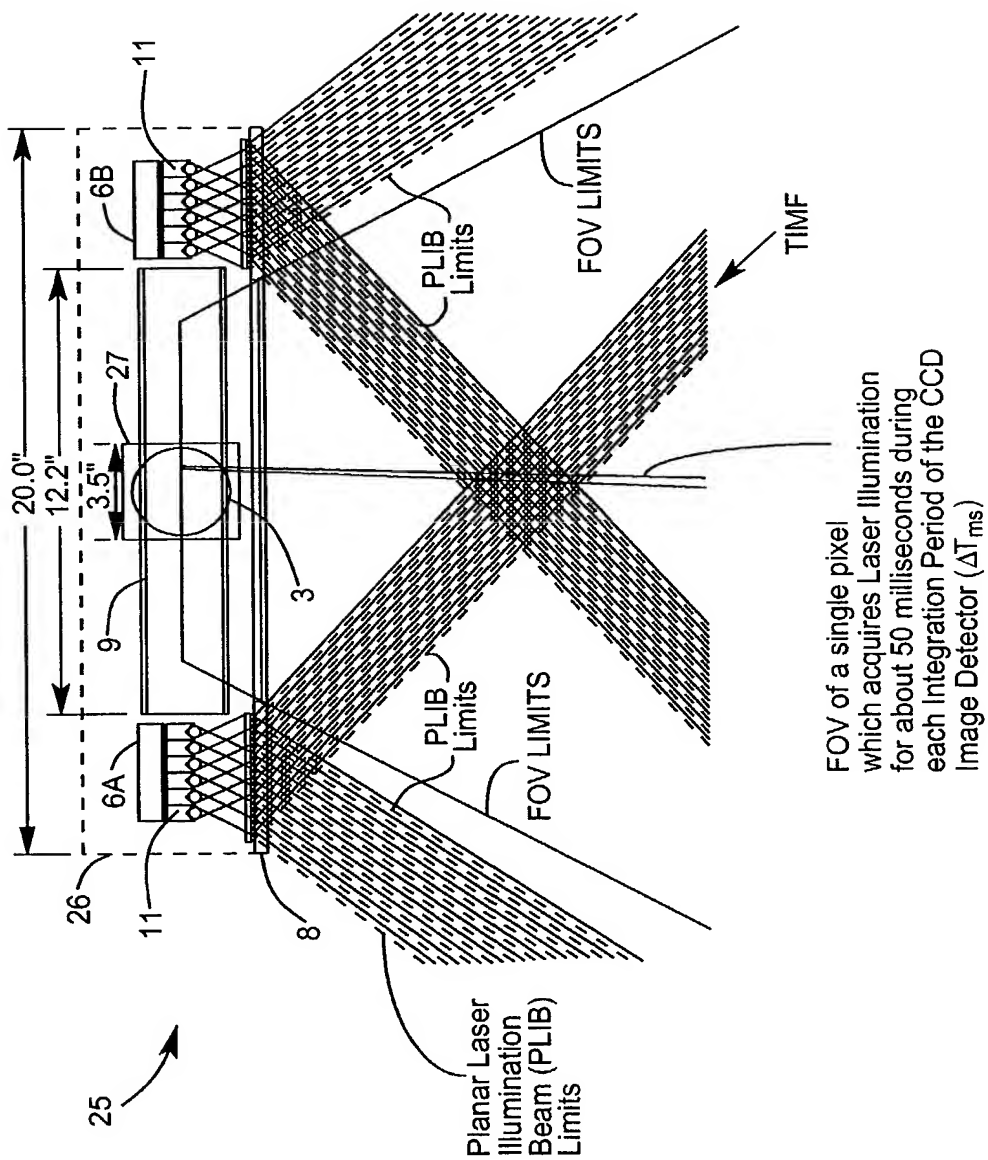


FIG. 1I13A

THE SECOND GENERALIZED SPECKLE-NOISE PATTERN REDUCTION  
METHOD OF THE PRESENT INVENTION

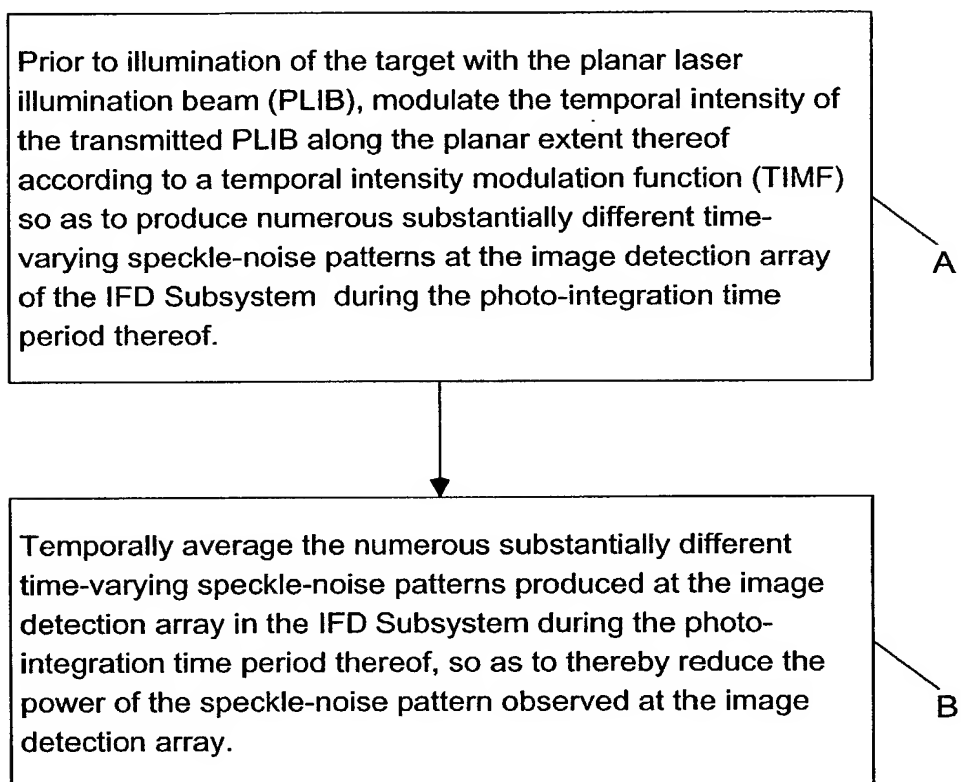


FIG. 1113B



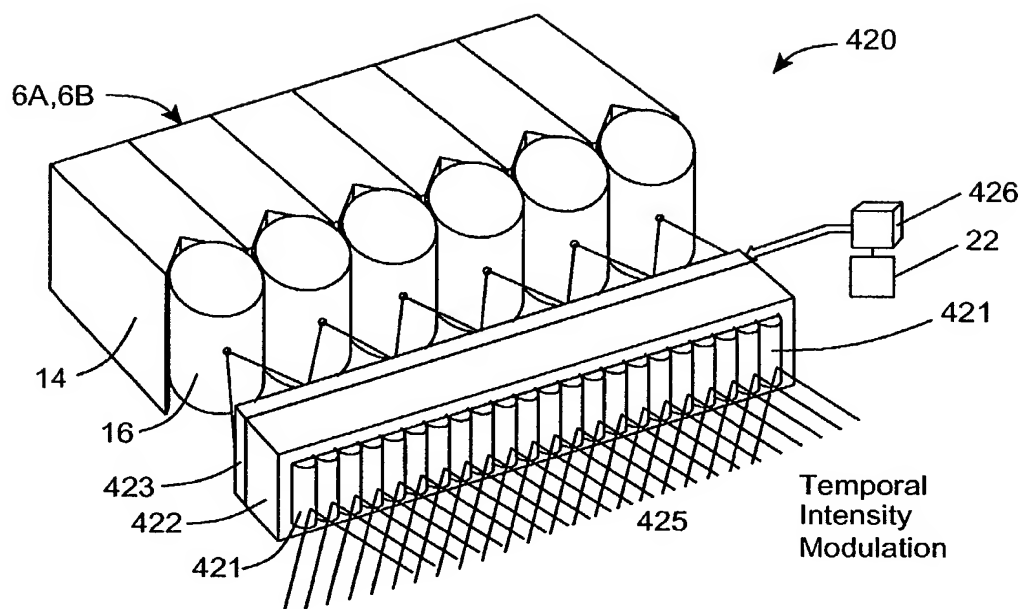


FIG. 1114A

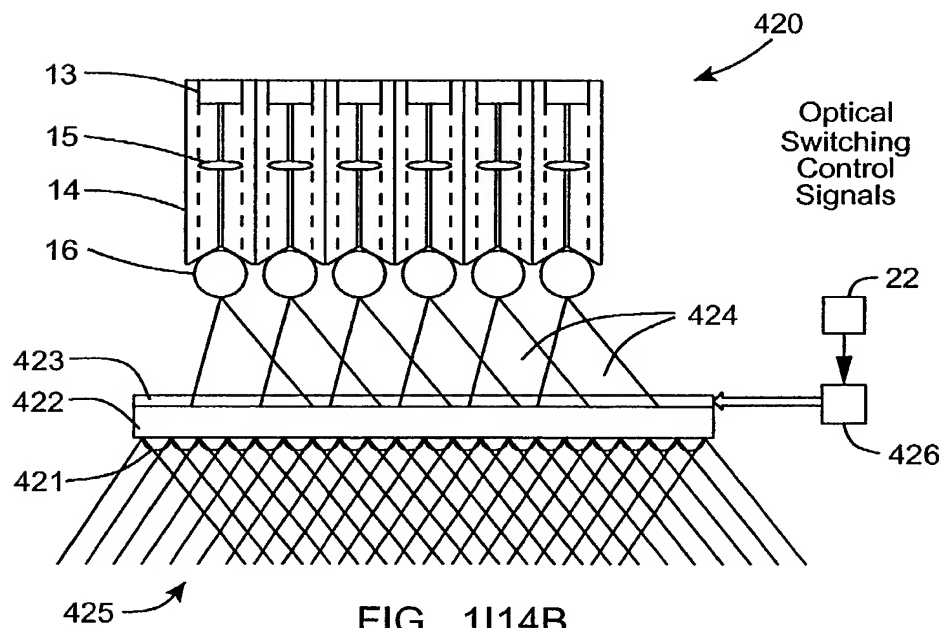


FIG. 1114B

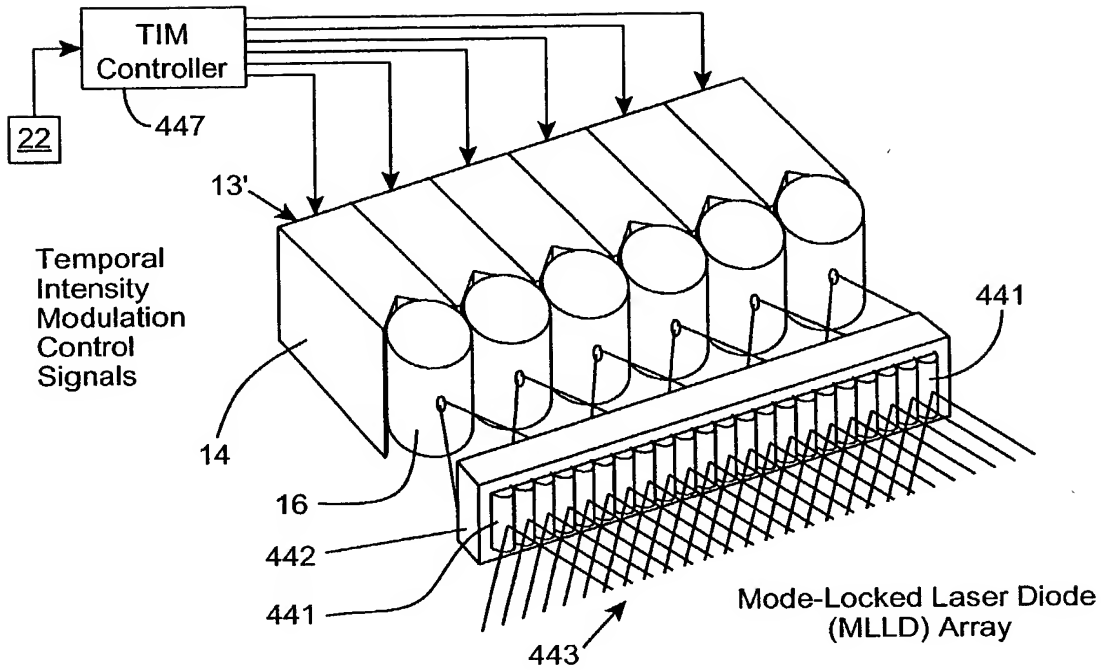


FIG. 1115A

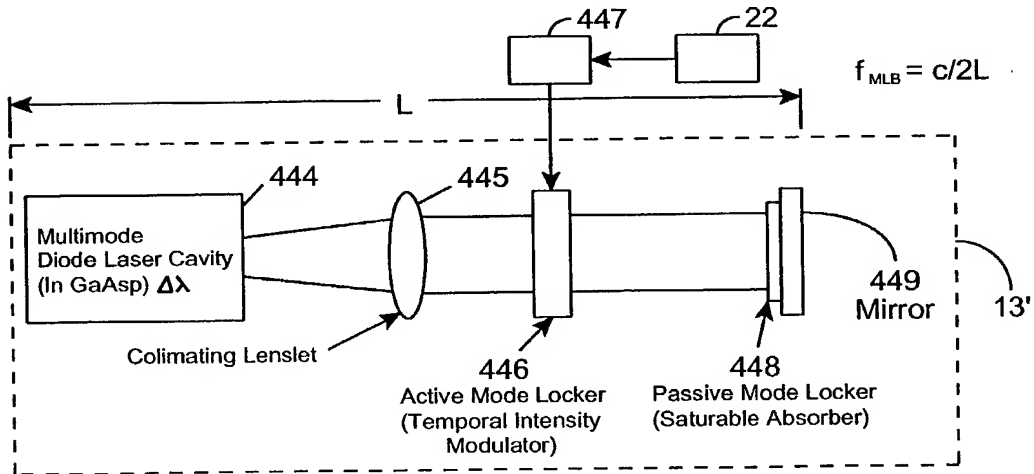


FIG. 1115B

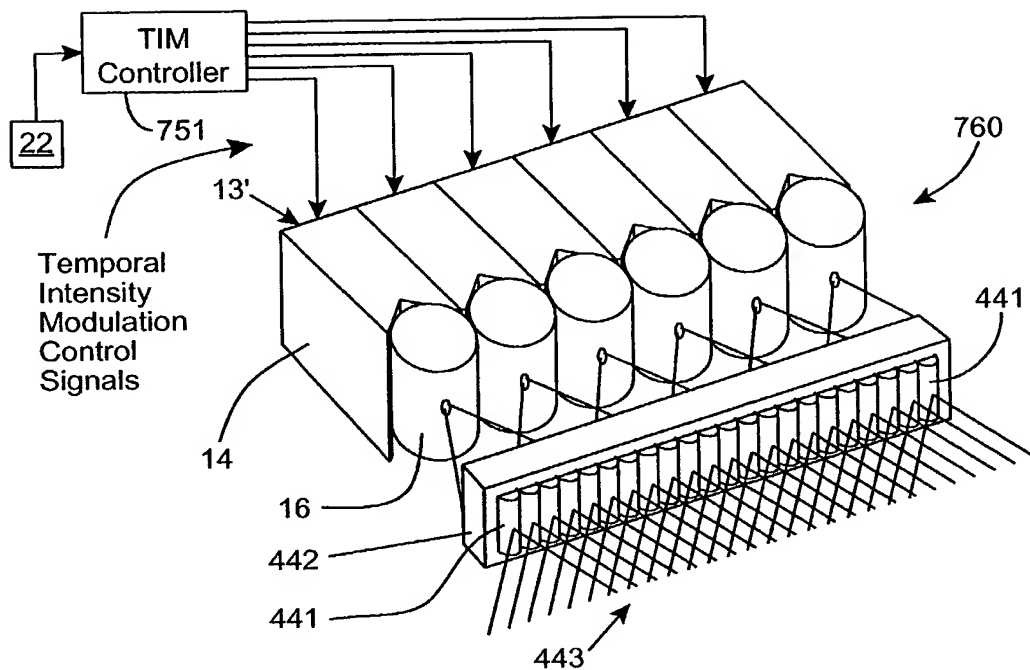


FIG. 1I15C

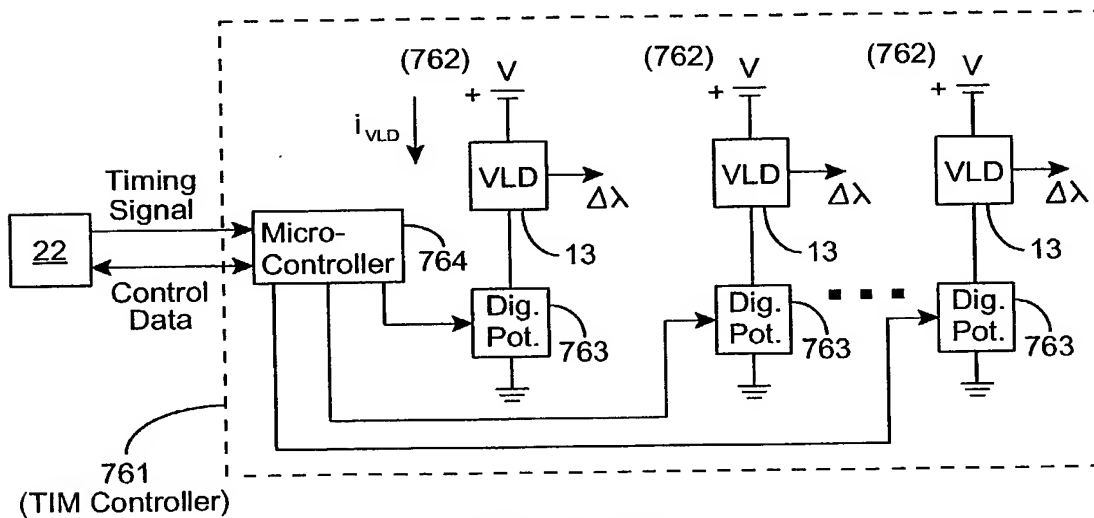


FIG. 1I15D

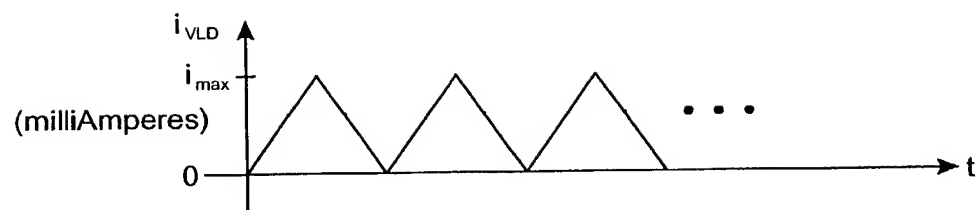


FIG. 1115E



FIG. 1115F

Third Generalized Method Of  
Reducing Speckle-Noise Patterns  
At Image Detection Array  
Of The IFD Subsystem (3)

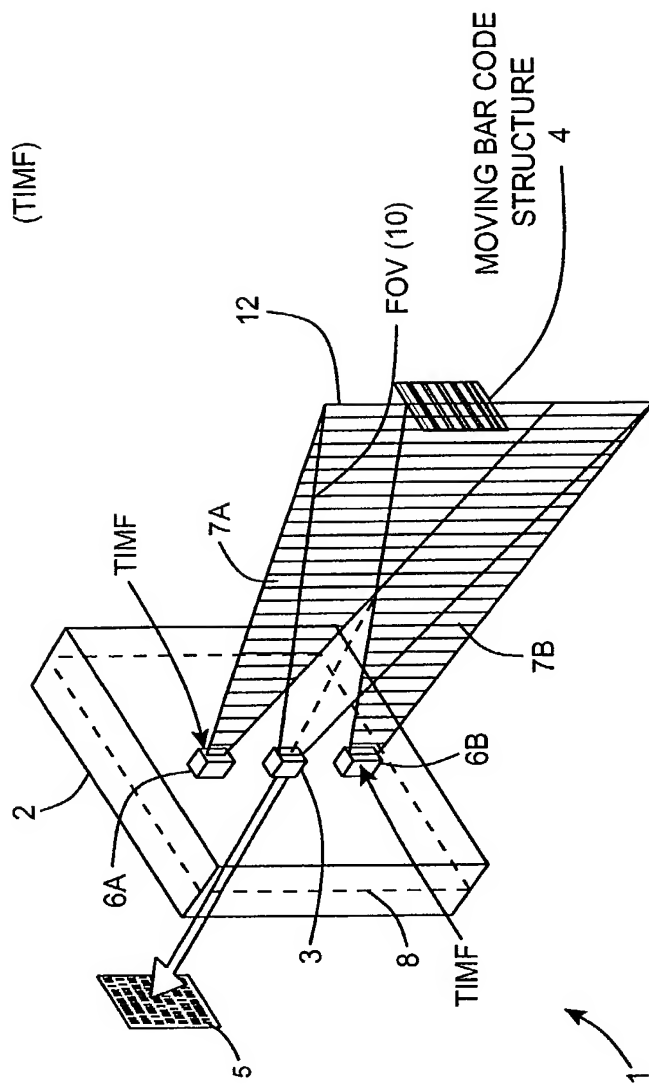


FIG. 1116

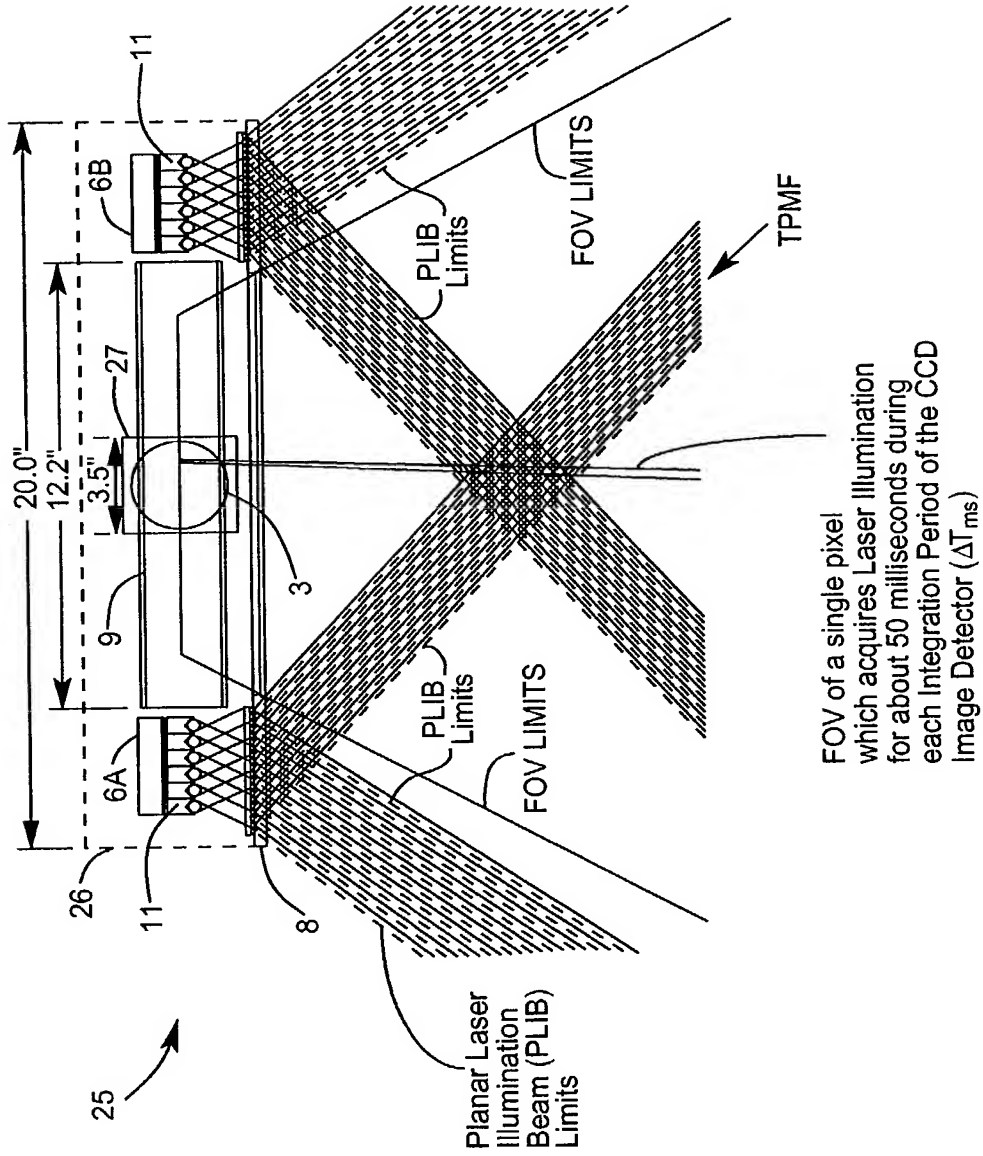


FIG. 1116A

THE THIRD GENERALIZED SPECKLE-NOISE PATTERN REDUCTION  
METHOD OF THE PRESENT INVENTION

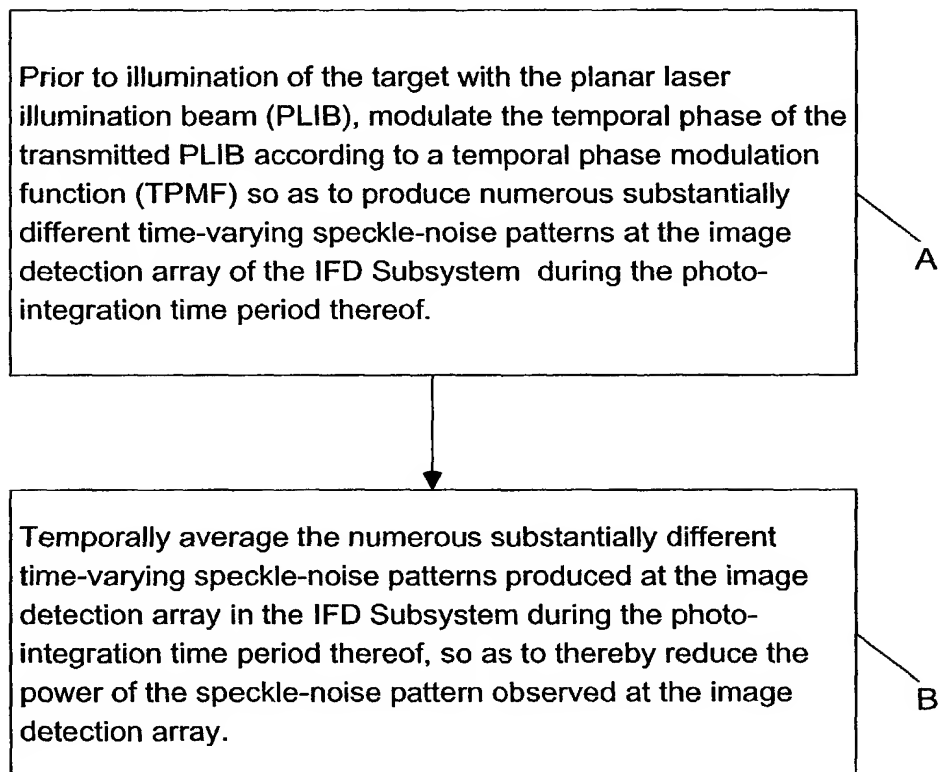
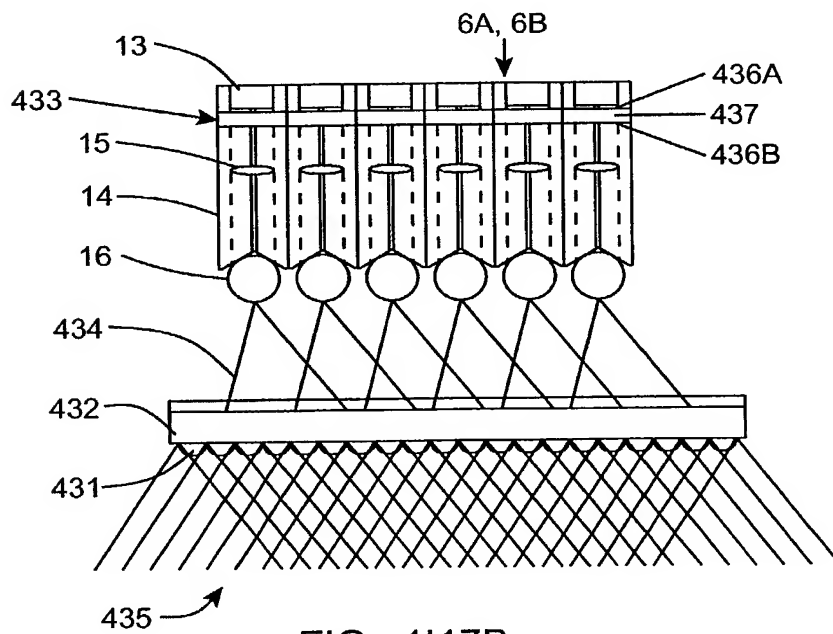
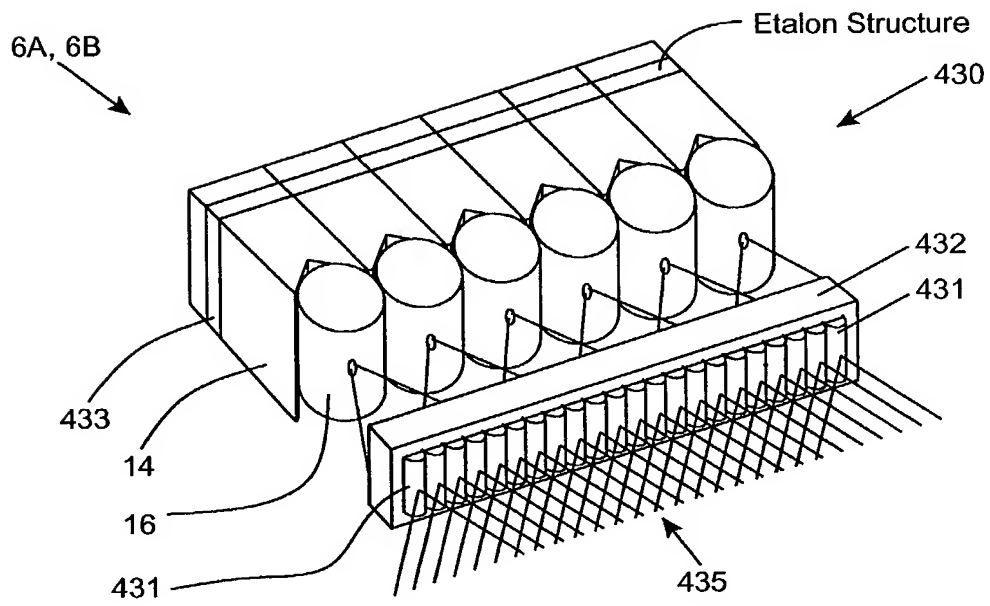


FIG. 1116B





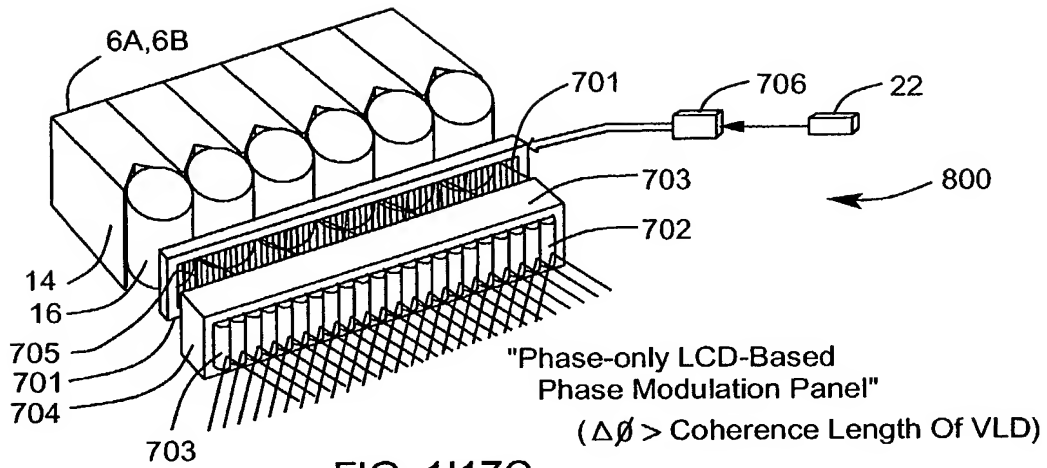


FIG. 1117C

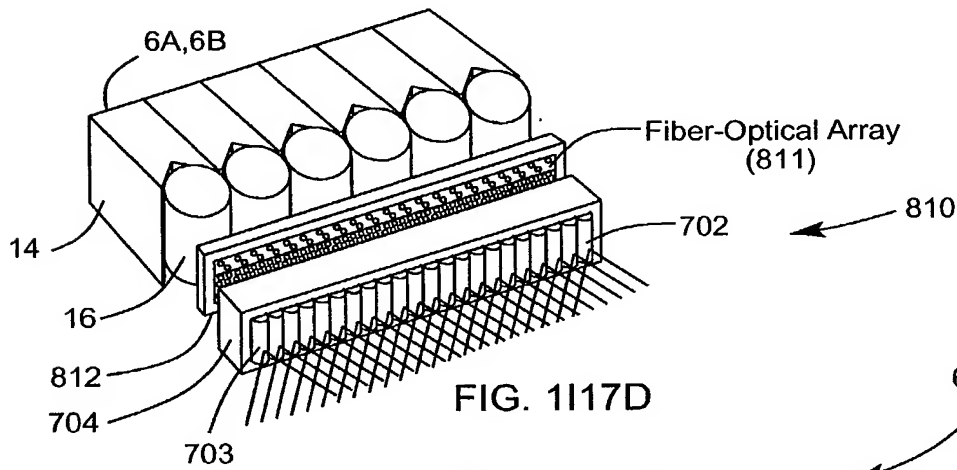


FIG. 1117D

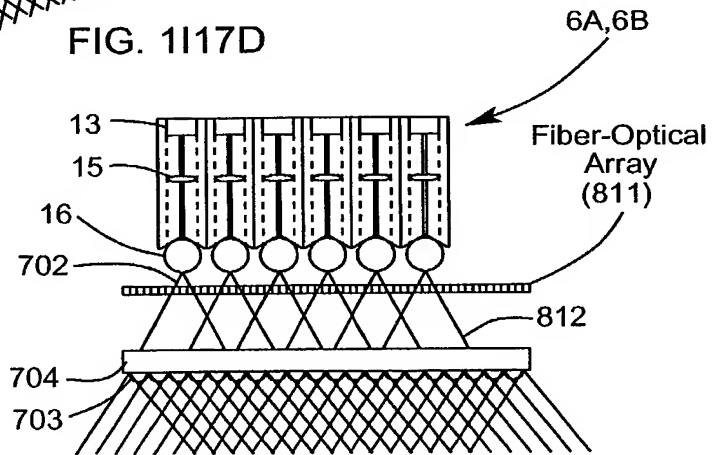


FIG. 1117E



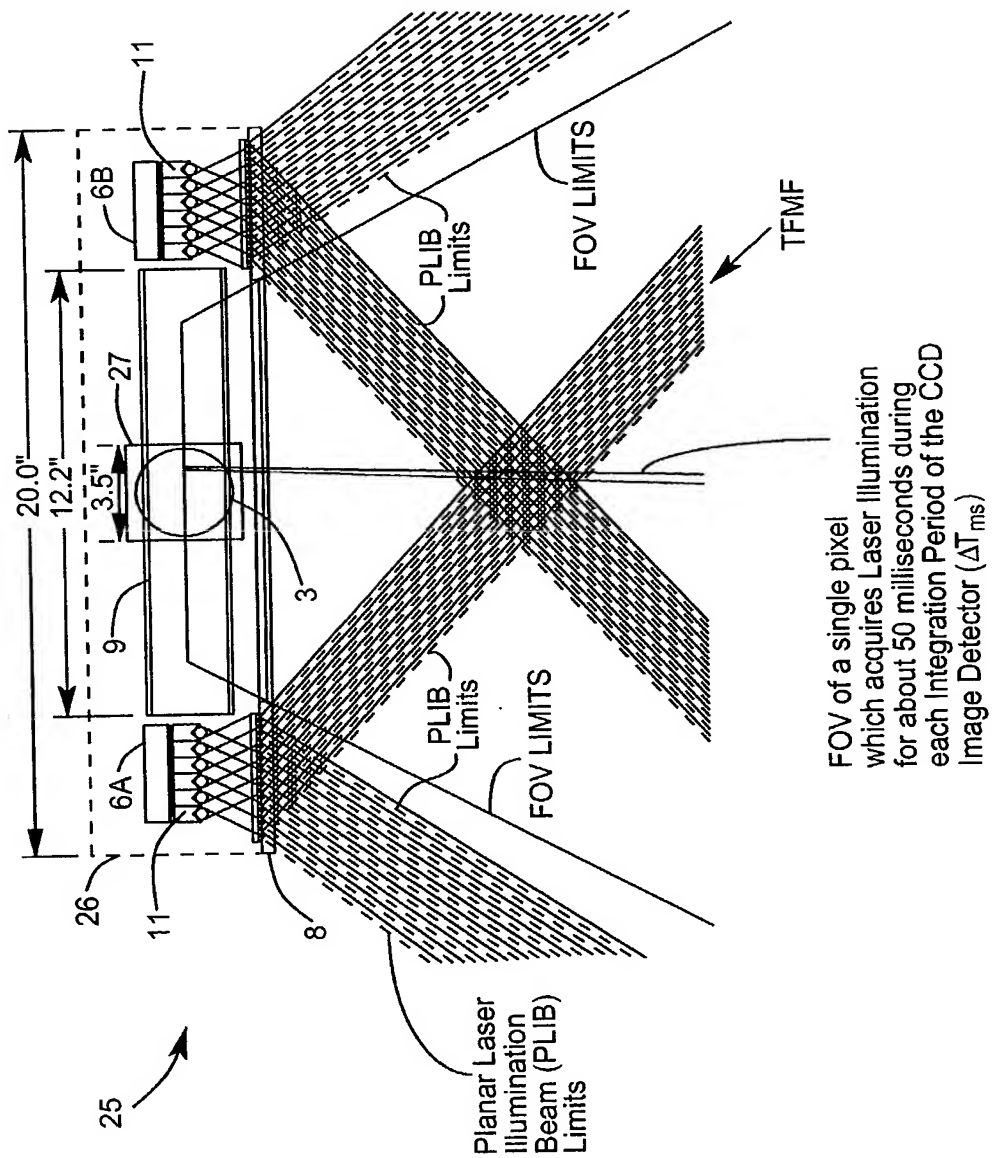


FIG. 1118A

Prior to illumination of the target with the planar laser illumination beam (PLIB), modulate the temporal frequency of the transmitted PLIB along the planar extent thereof according to a temporal intensity modulation function (TIMF) so as to produce numerous substantially different time-varying speckle-noise patterns at the image detection array of the IFD Subsystem during the photo-integration time period thereof.

Temporally average the numerous substantially different time-varying speckle-noise patterns produced at the image detection array in the IFD Subsystem during the photo-integration time period thereof, so as to thereby reduce the power of the speckle-noise pattern observed at the image detection array.

FIG. 1118B

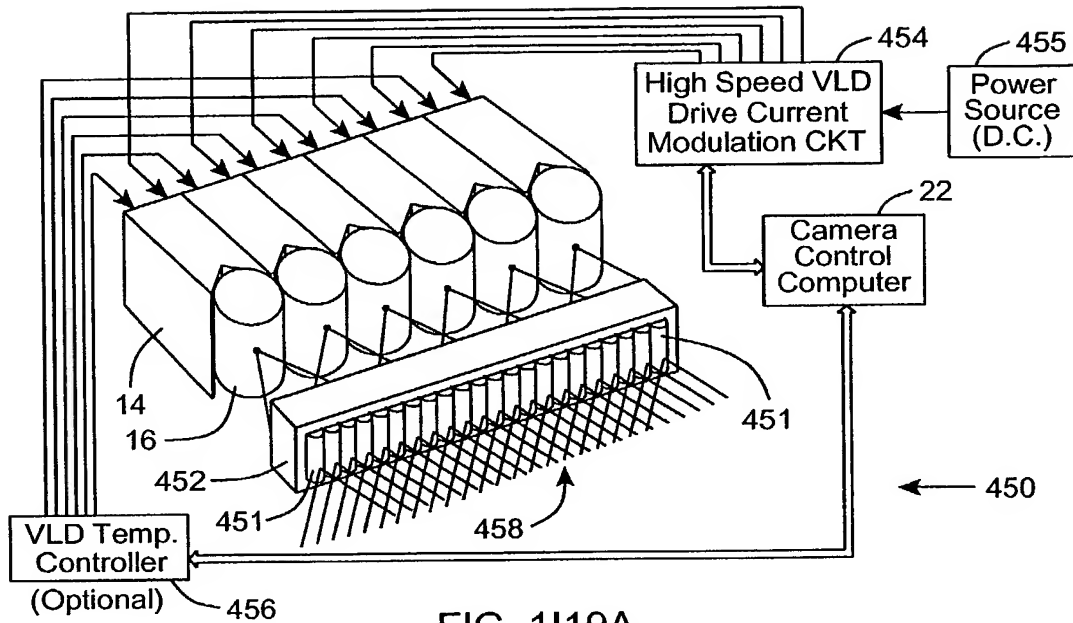


FIG. 1119A

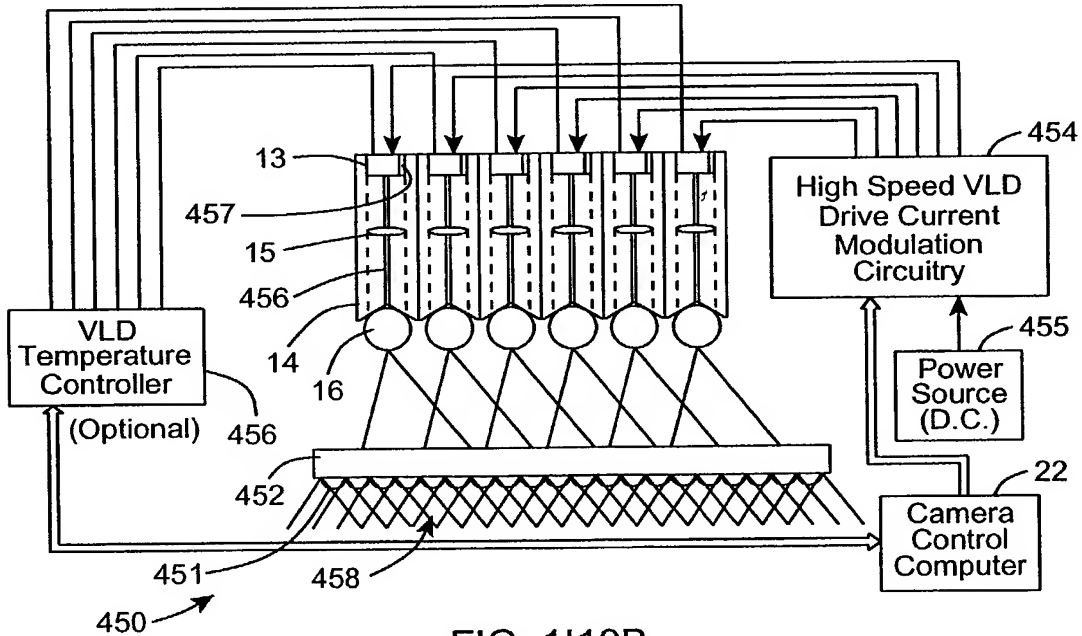


FIG. 1119B

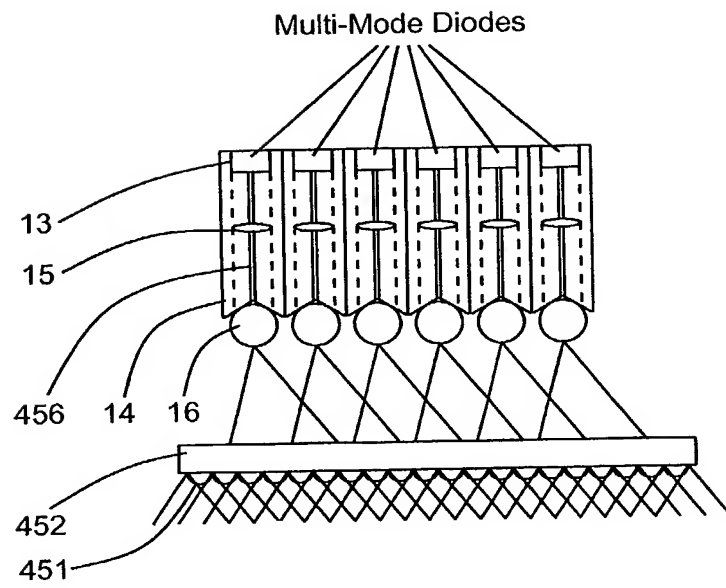


FIG. 1119C

Fifth Generalized Method Of  
Reducing Speckle-Noise Patterns  
At Image Detection Array  
Of The IFD Subsystem (3)

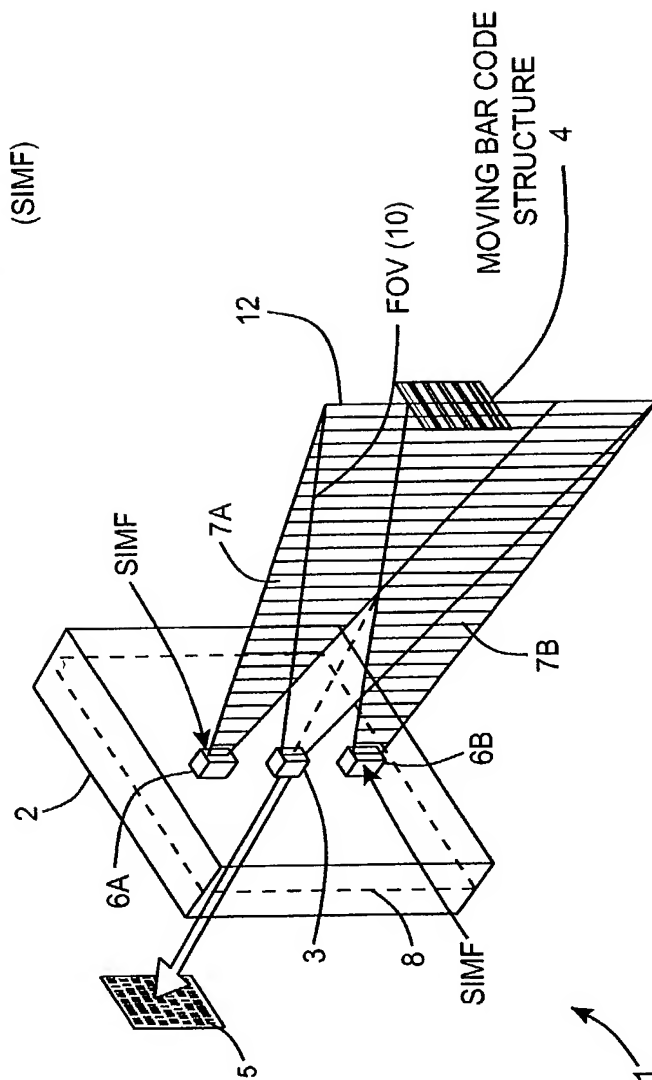


FIG. 1120

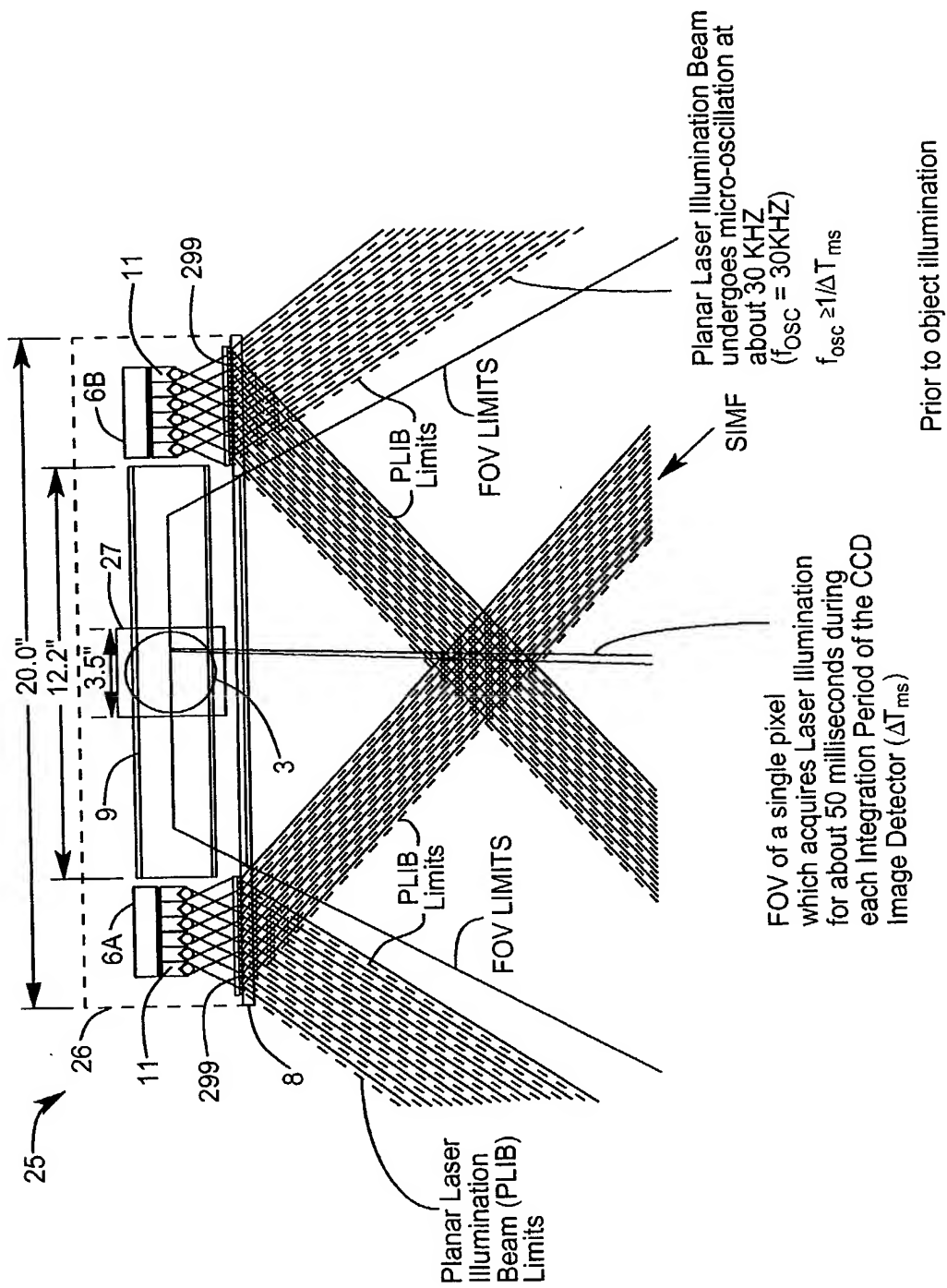


FIG. 1120A



THE FIFTH GENERALIZED SPECKLE-NOISE PATTERN REDUCTION  
METHOD OF THE PRESENT INVENTION

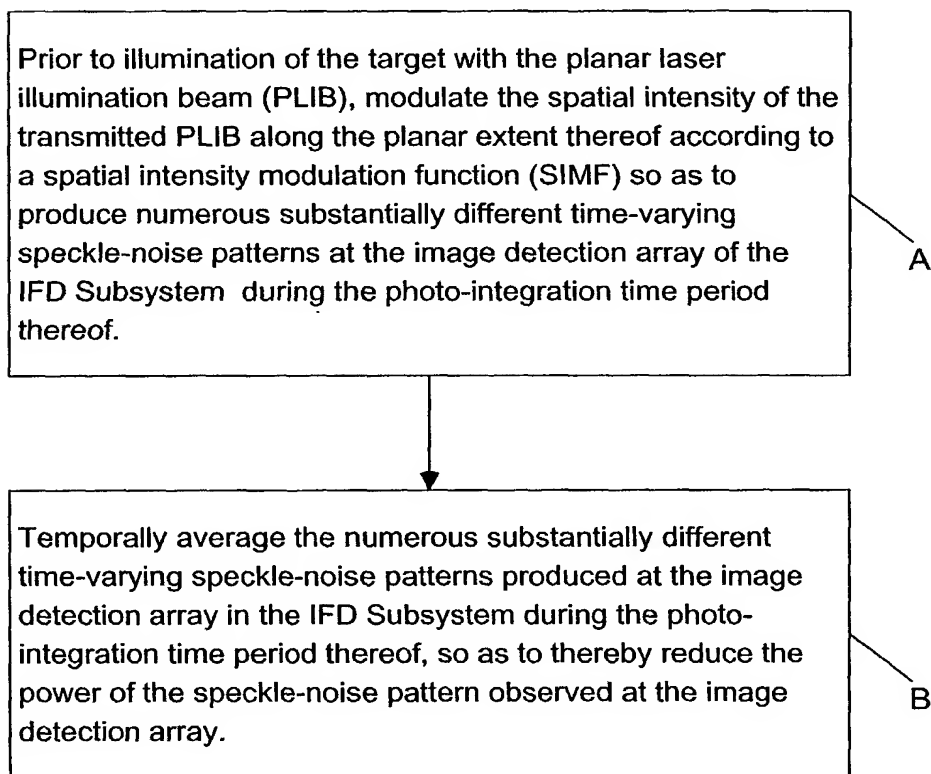
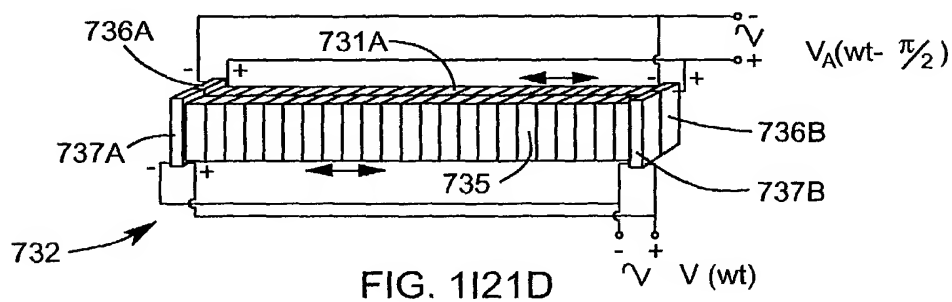
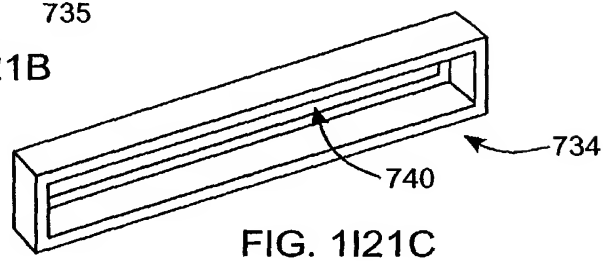
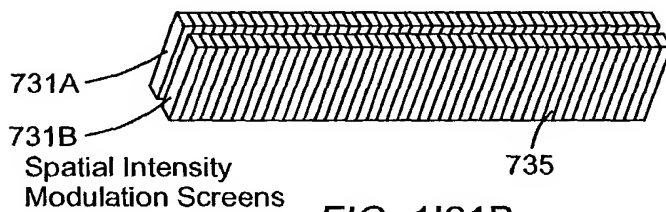
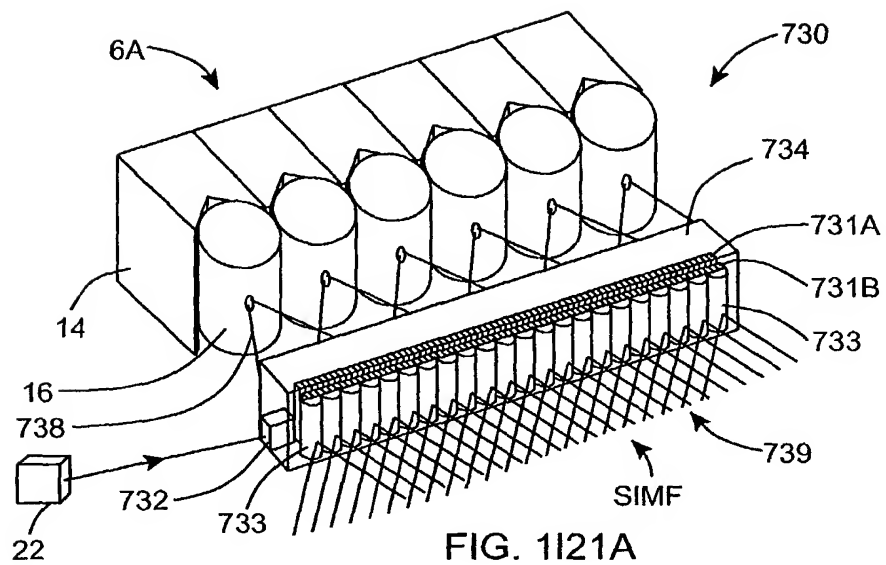


FIG. 1120B



Sixth Generalized Method Of  
Reducing Speckle-Noise Patterns  
At Image Detection Array  
Of The IFD Subsystem (3)

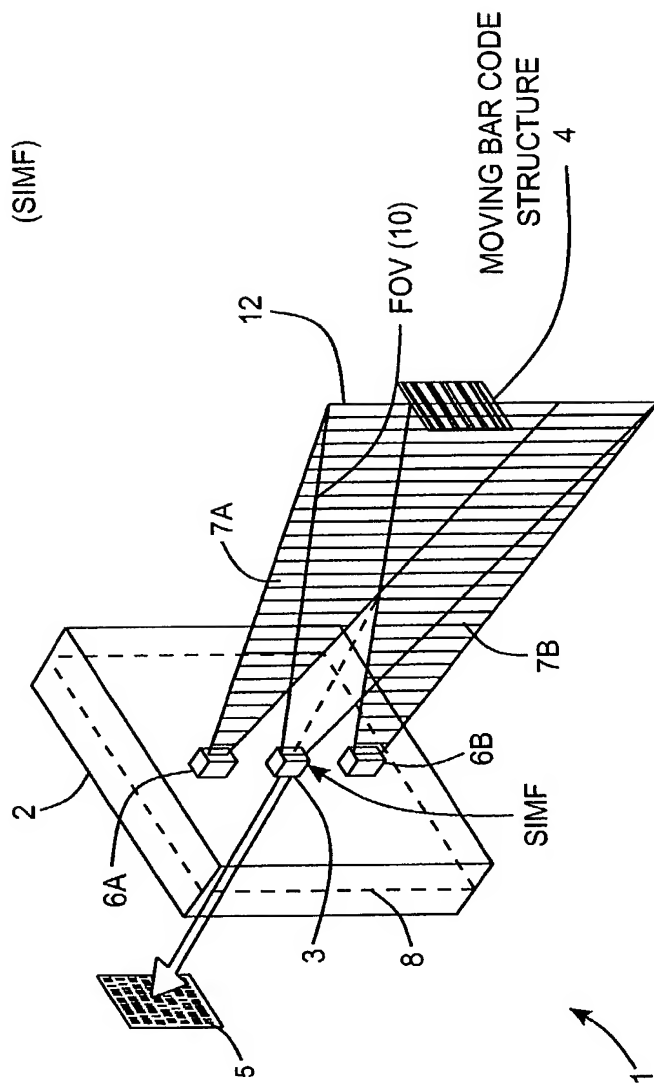


FIG. 1122

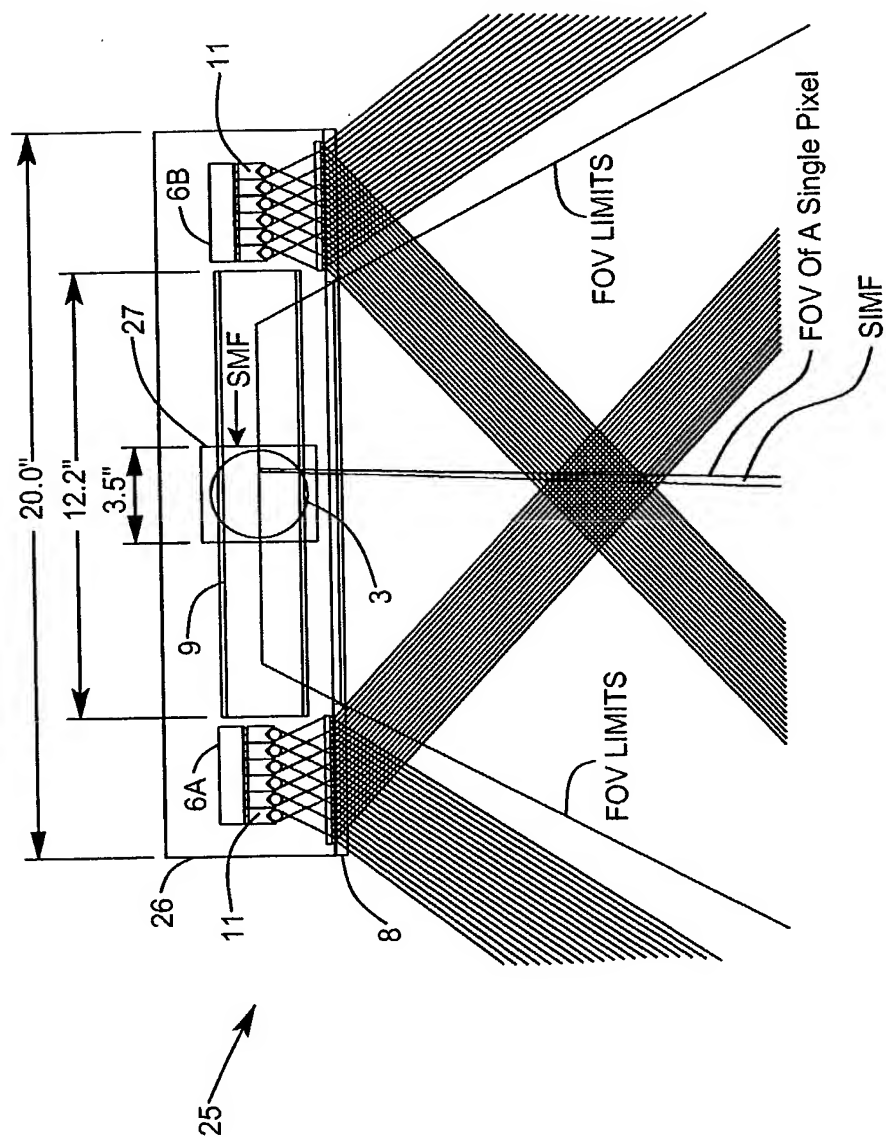
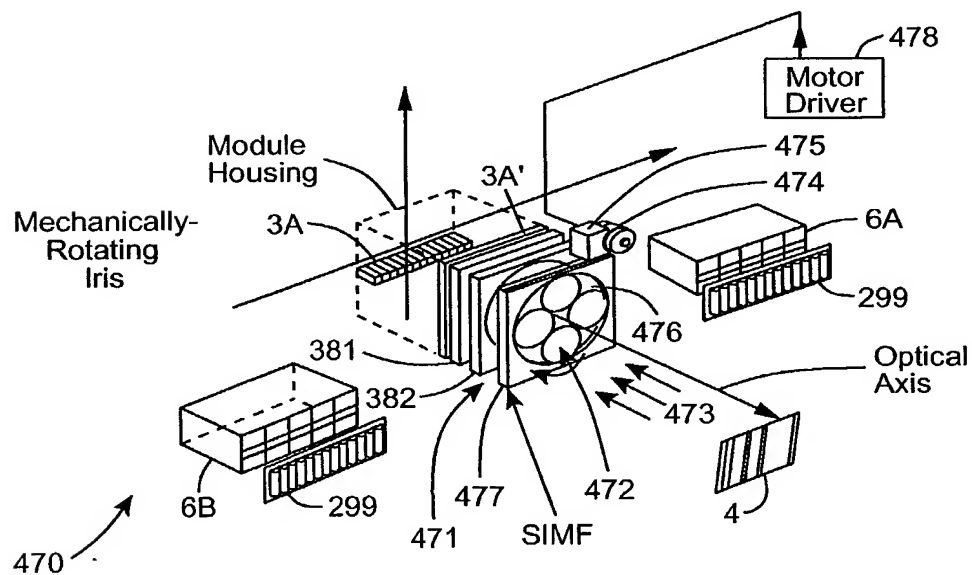
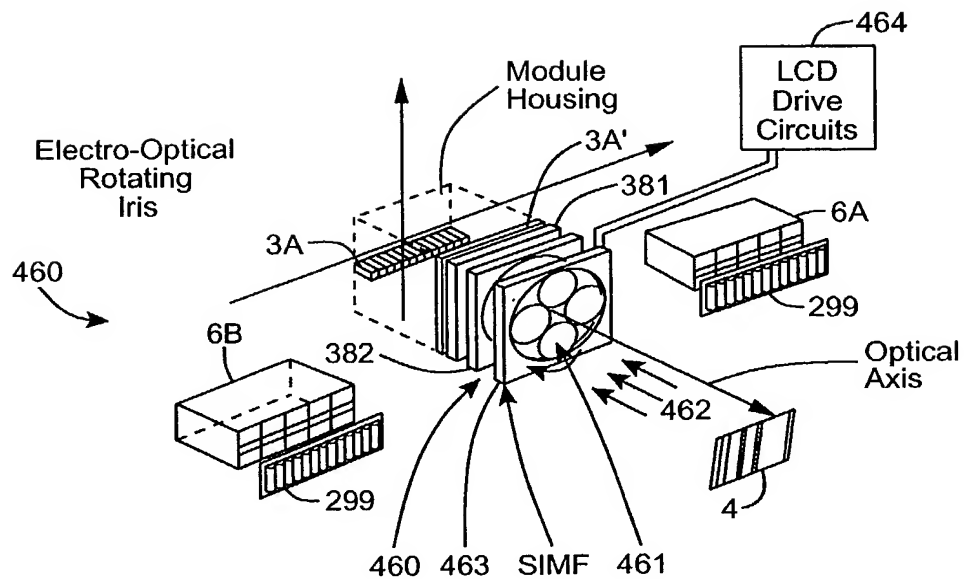


FIG. 1122A





Seventh Generalized Method Of  
Reducing Speckle-Noise Patterns  
At Image Detection Array  
Of The IFD Subsystem (3)

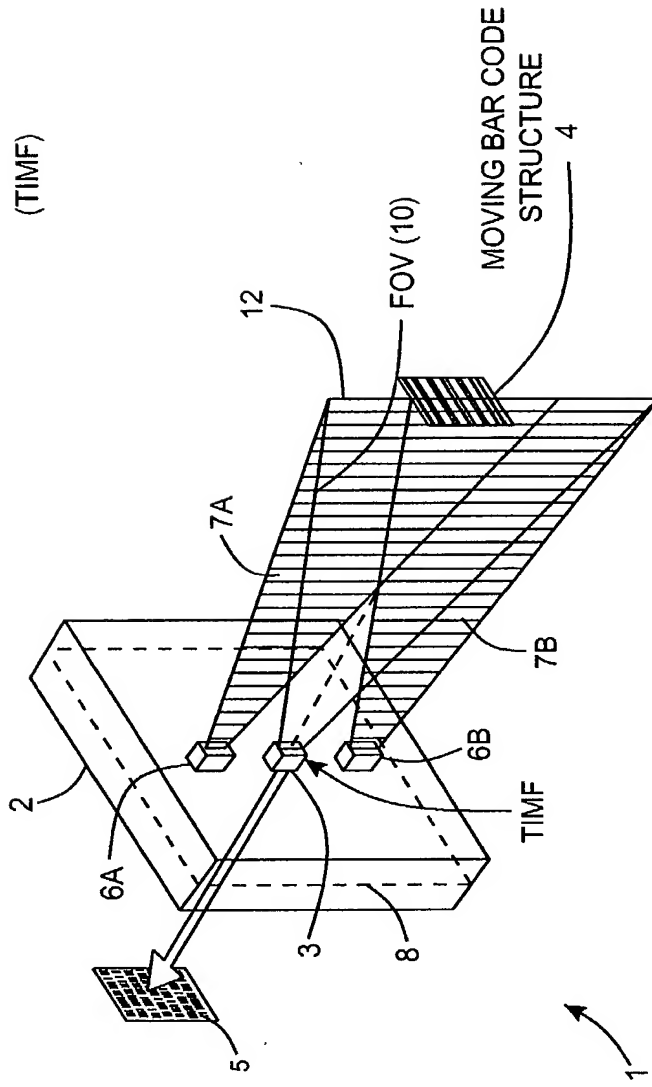


FIG. 1124

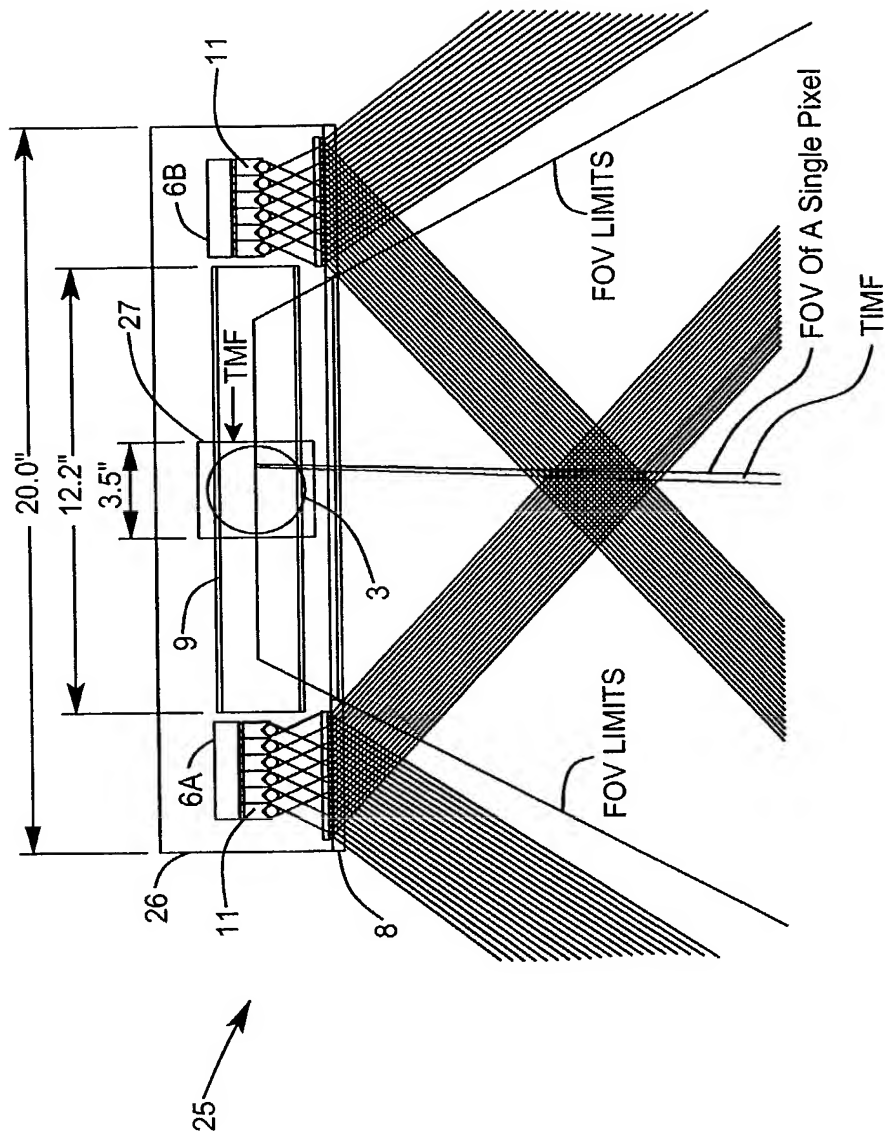


FIG. 1124A



THE SEVENTH GENERALIZED SPECKLE-NOISE PATTERN REDUCTION  
METHOD OF THE PRESENT INVENTION

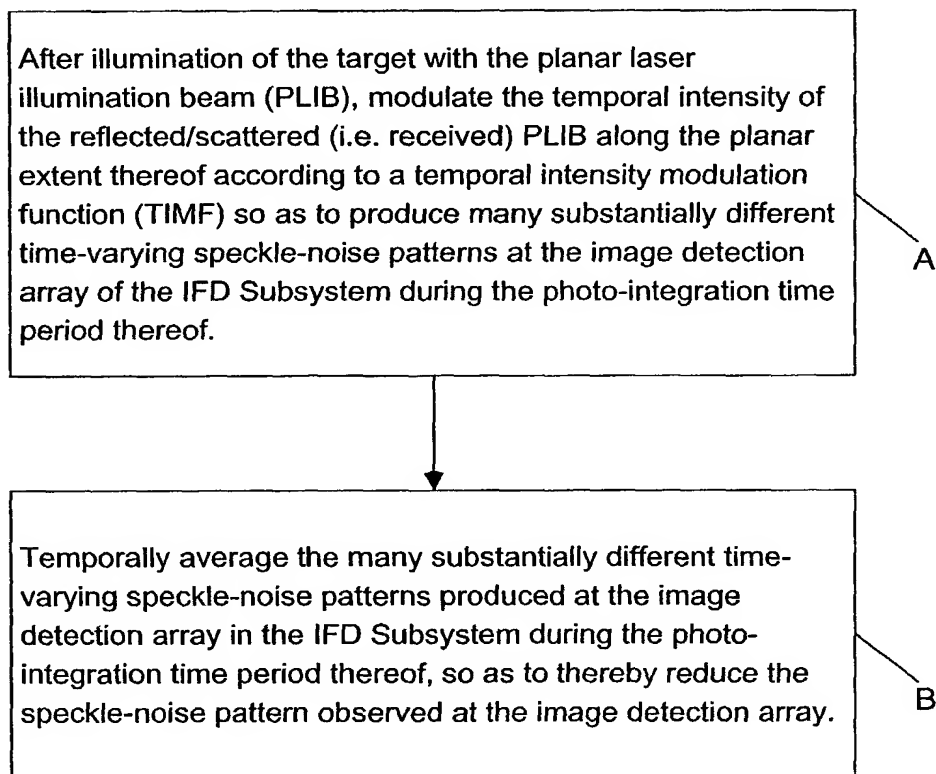


FIG. 1124B

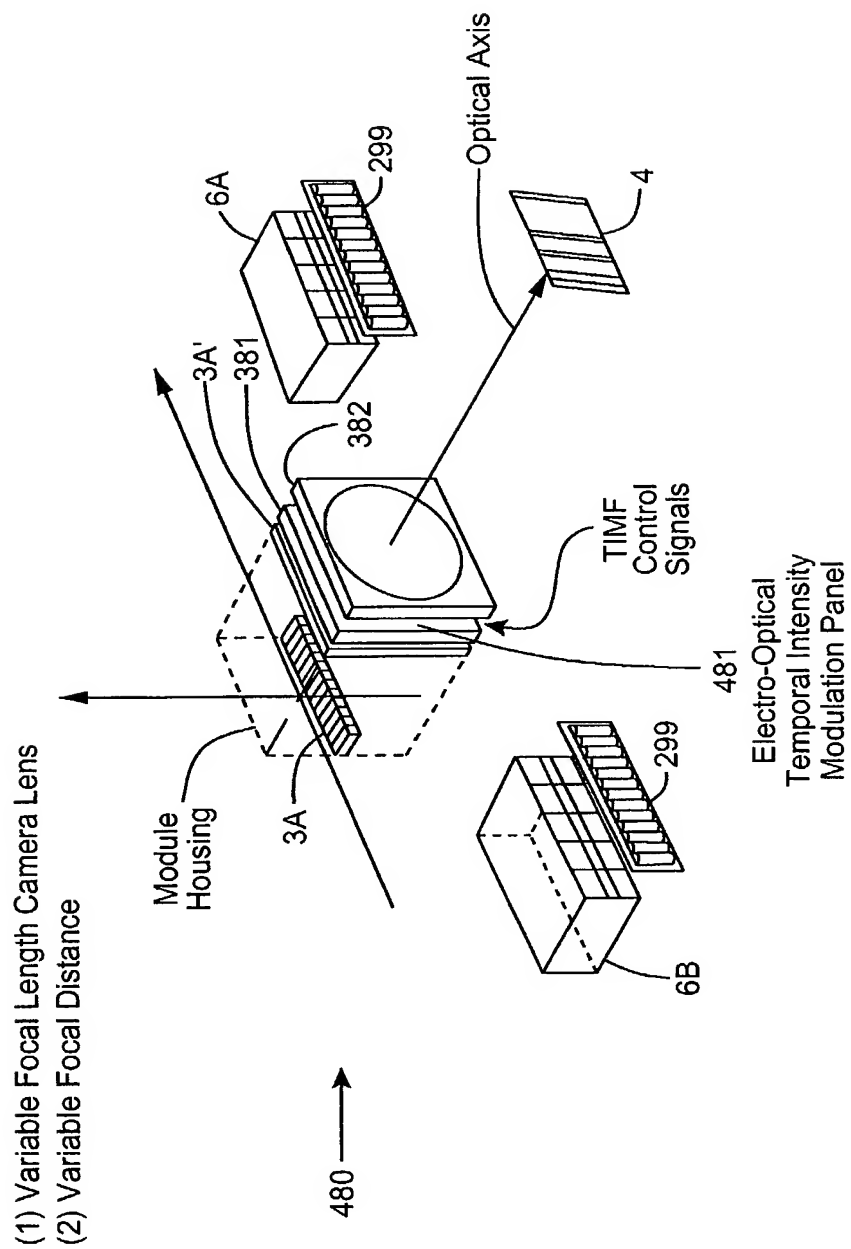


FIG. 1124C

THE EIGHT GENERALIZED SPECKLE-NOISE PATTERN REDUCTION  
METHOD OF THE PRESENT INVENTION

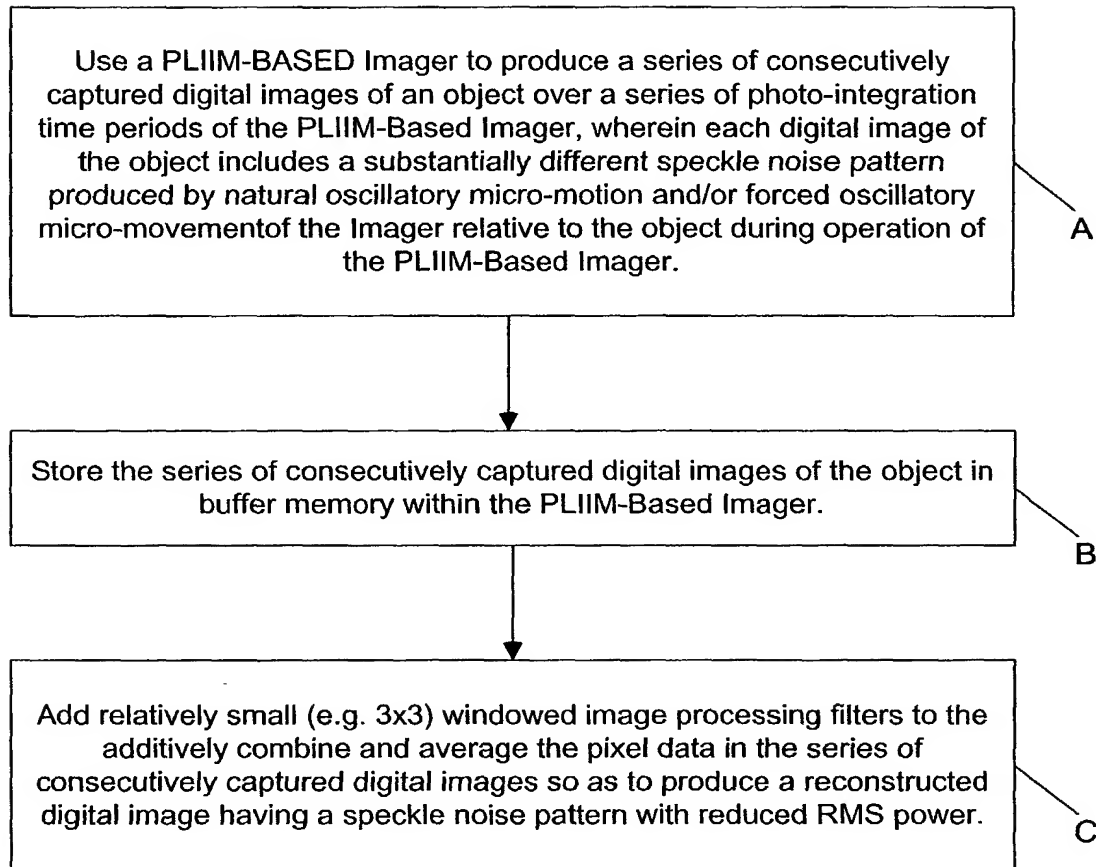
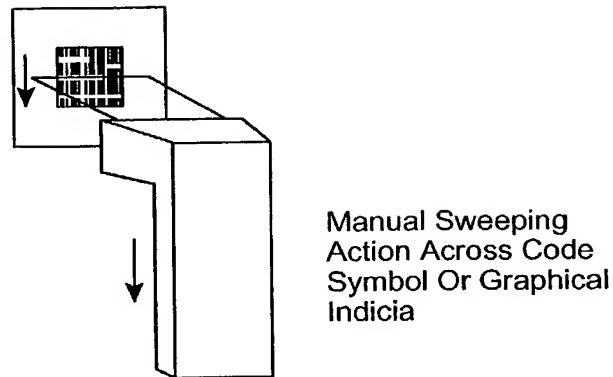
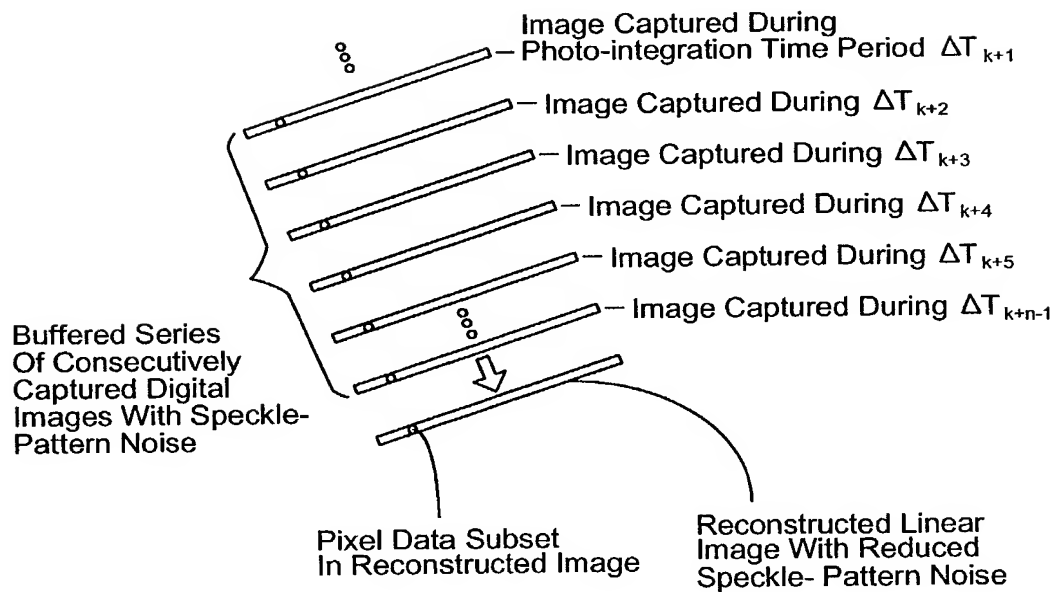


FIG. 1124D



Manual Sweeping  
Action Across Code  
Symbol Or Graphical  
Indicia

FIG. 1124E



Case: Linear Imager

FIG. 1124F

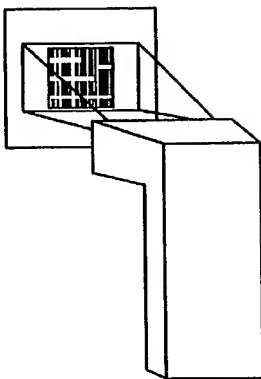
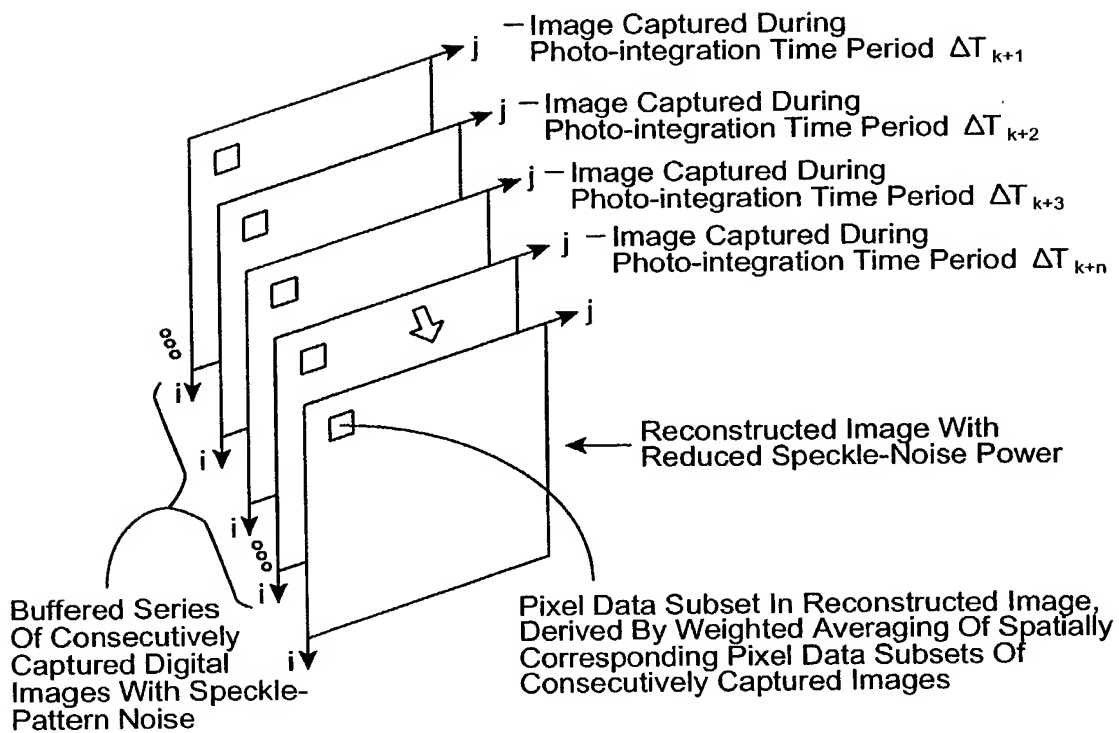


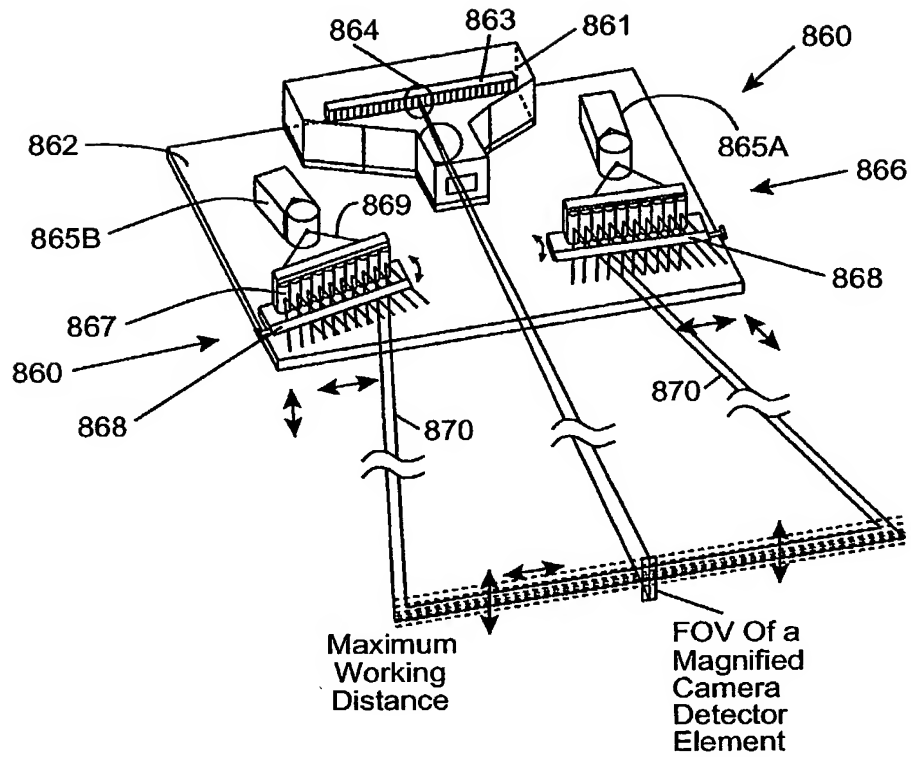
FIG. 1I24G



Case: 2D Area Imager

FIG. 1I24H





\* Lateral And Transverse Micro-oscillation Of PLIB

FIG. 1125A1

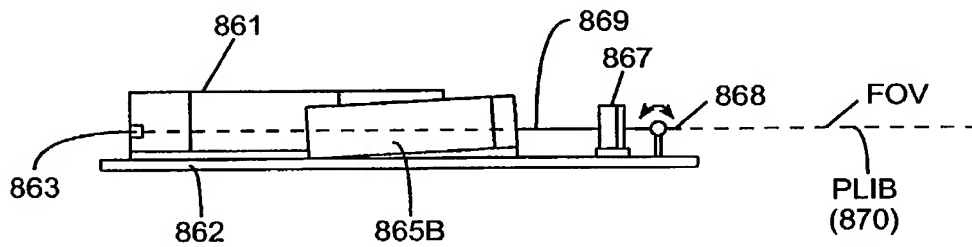


FIG. 1125A2

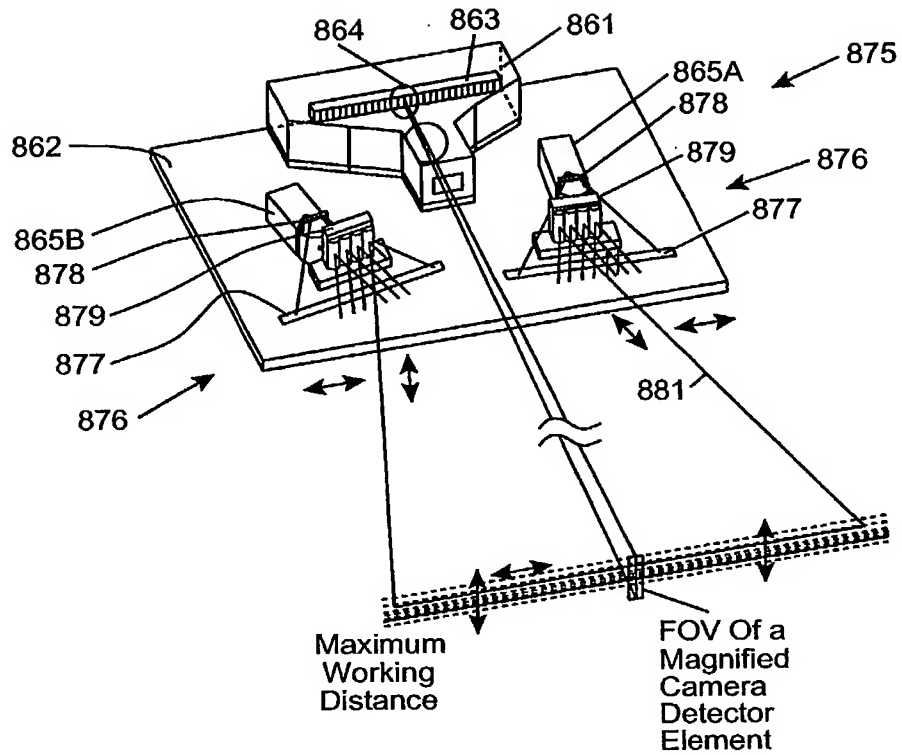


FIG. 1125B1

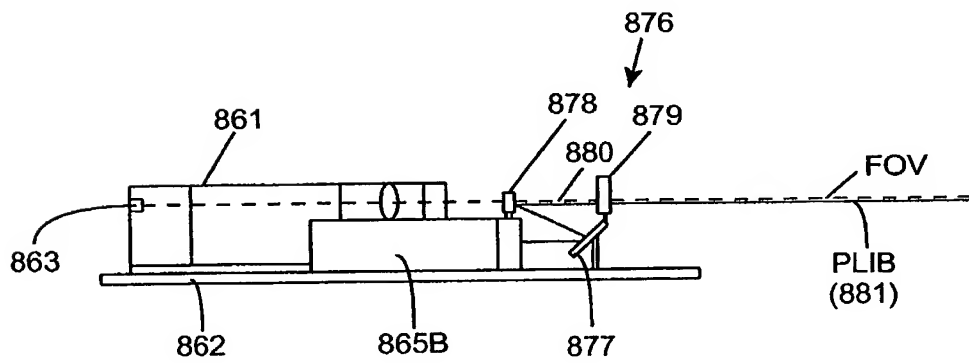


FIG. 1125B2



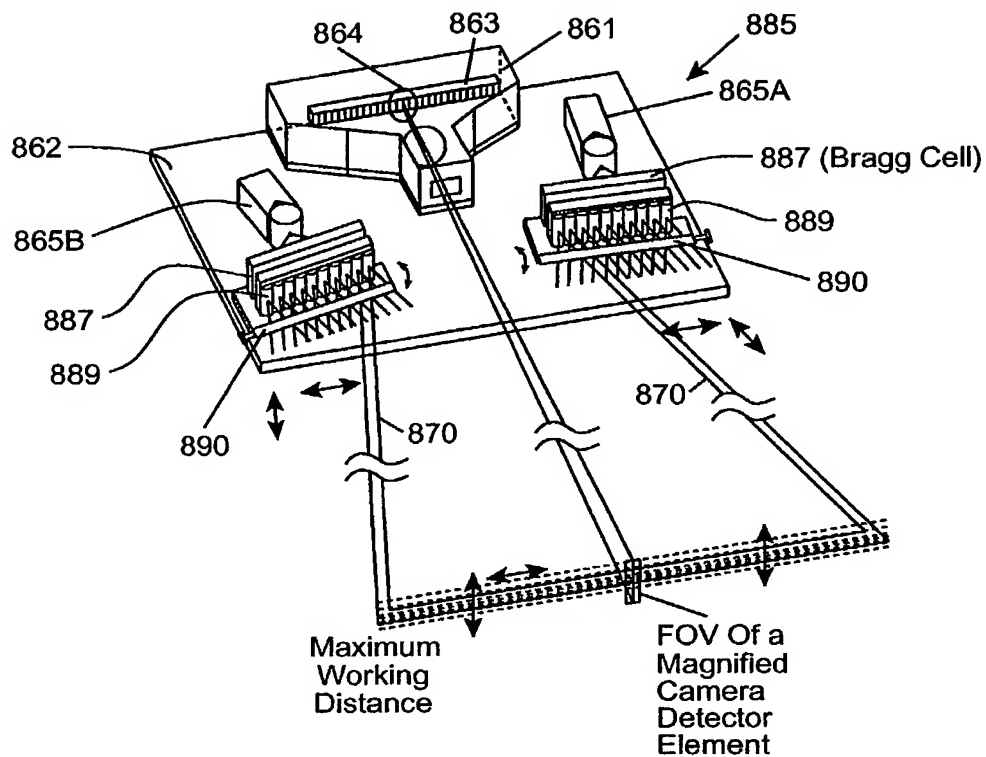


FIG. 1I25C1

\* Lateral And  
Transverse  
Micro-oscillation  
Of PLIB

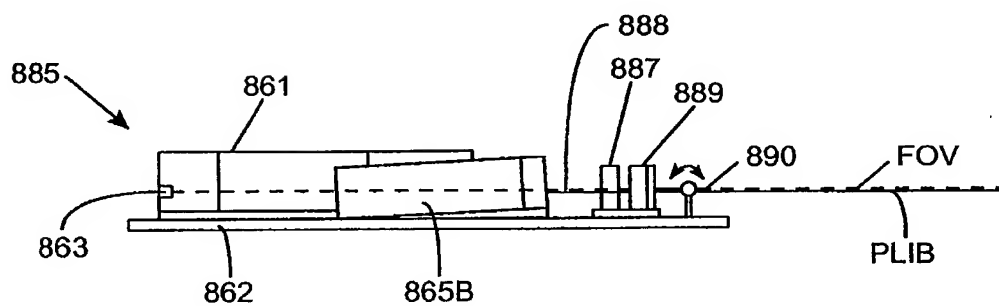


FIG. 1I25C2

10/012

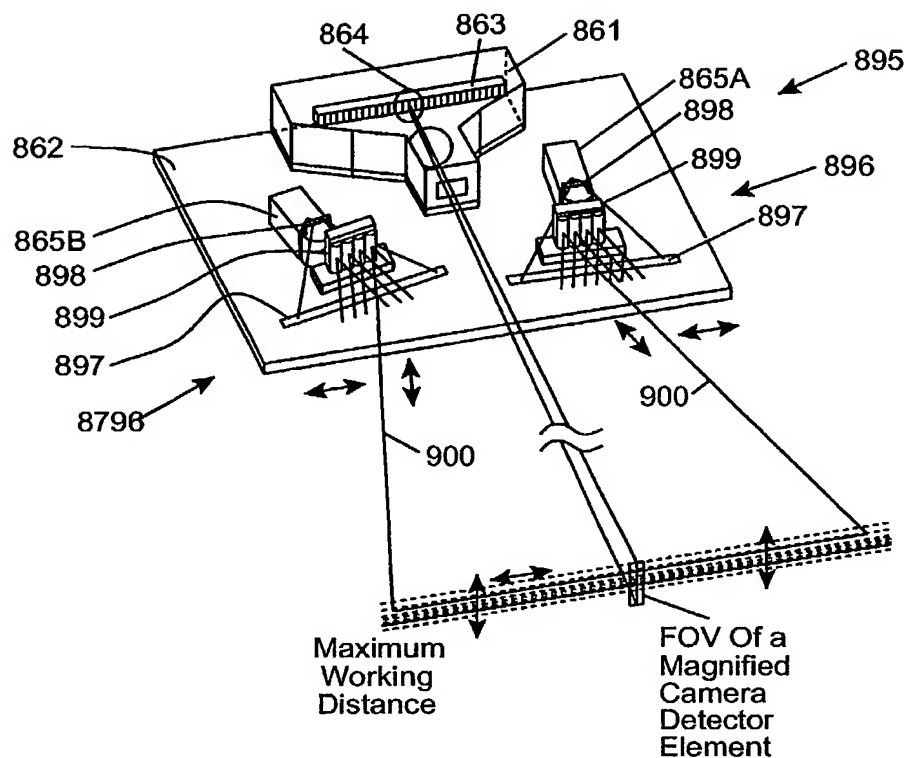


FIG. 1125D1

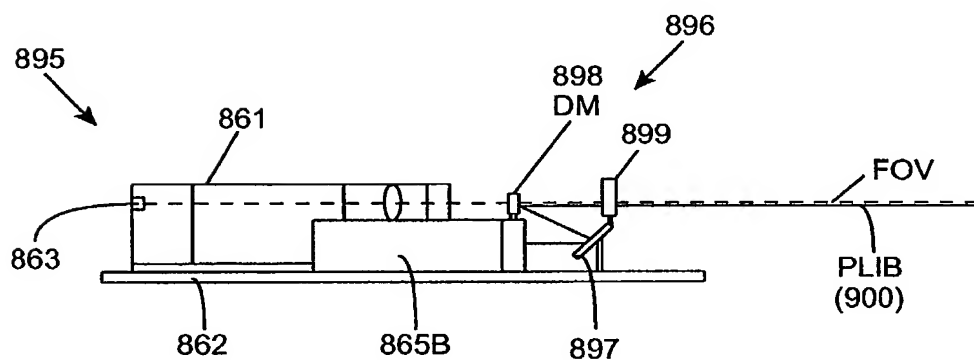


FIG. 1125D2

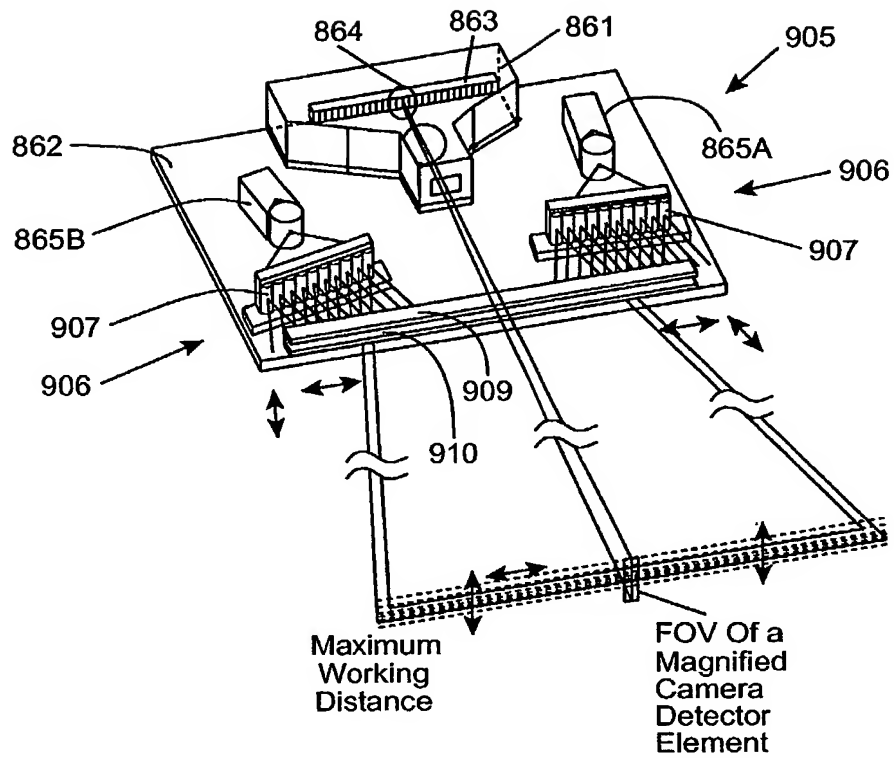


FIG. 1125E1

\* Lateral And Transverse Micro-oscillation Of PLIB

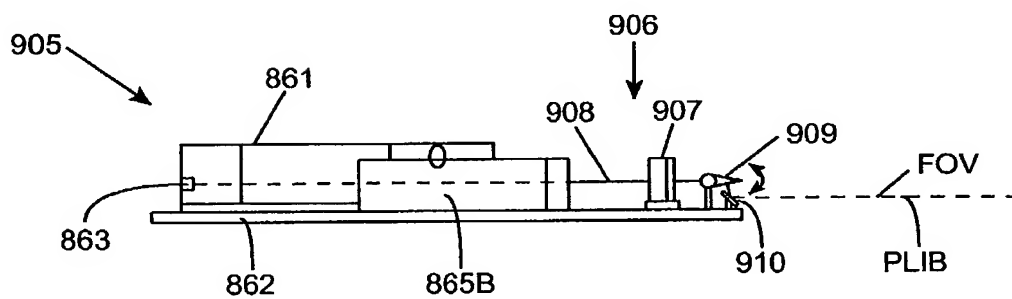


FIG. 1125E2

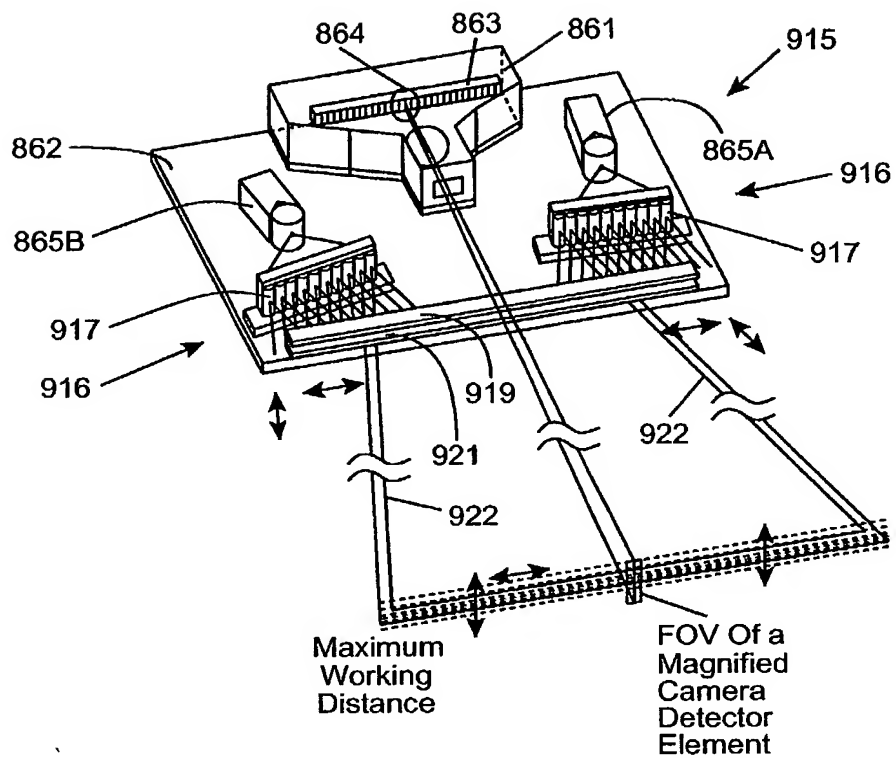


FIG. 1125F1

\* Lateral And  
Transverse  
Micro-oscillation  
Of PLIB

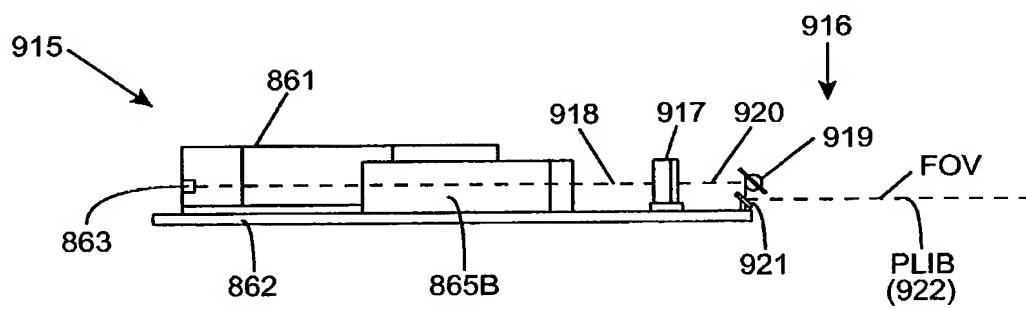
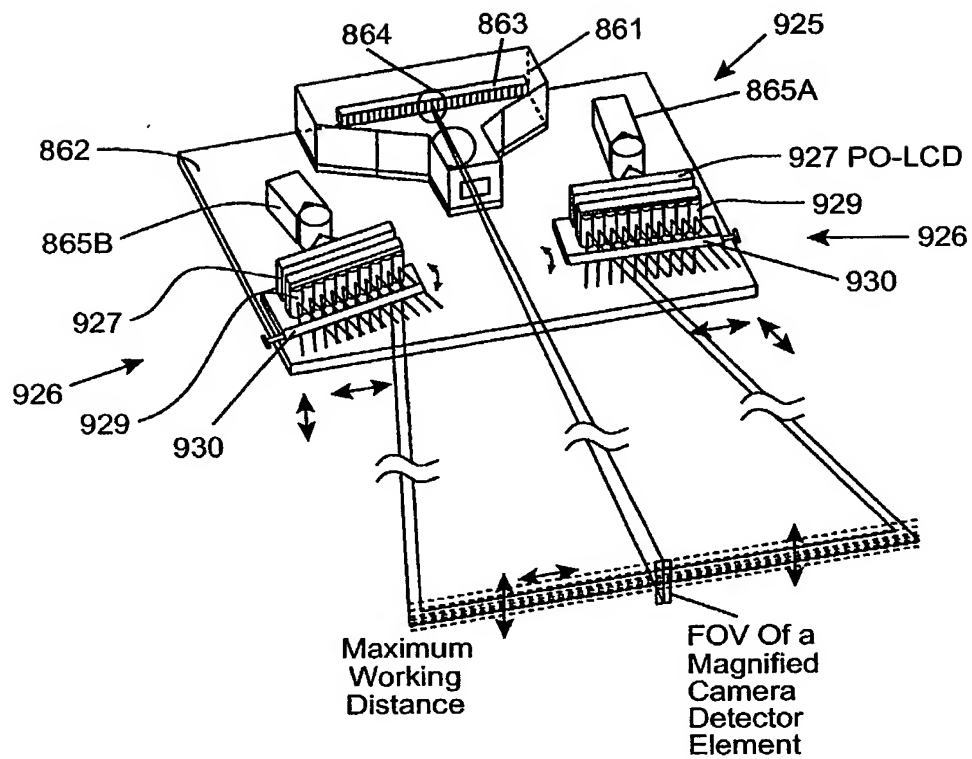


FIG. 1125F2



\* Lateral And Transverse Micro-oscillation Of PLIB

FIG. 1I25G1

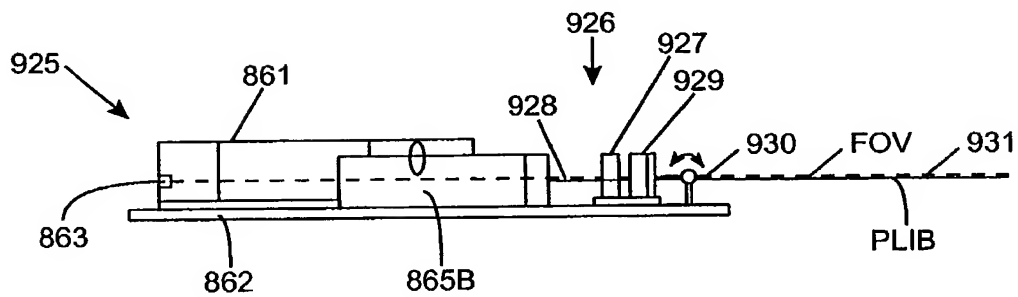
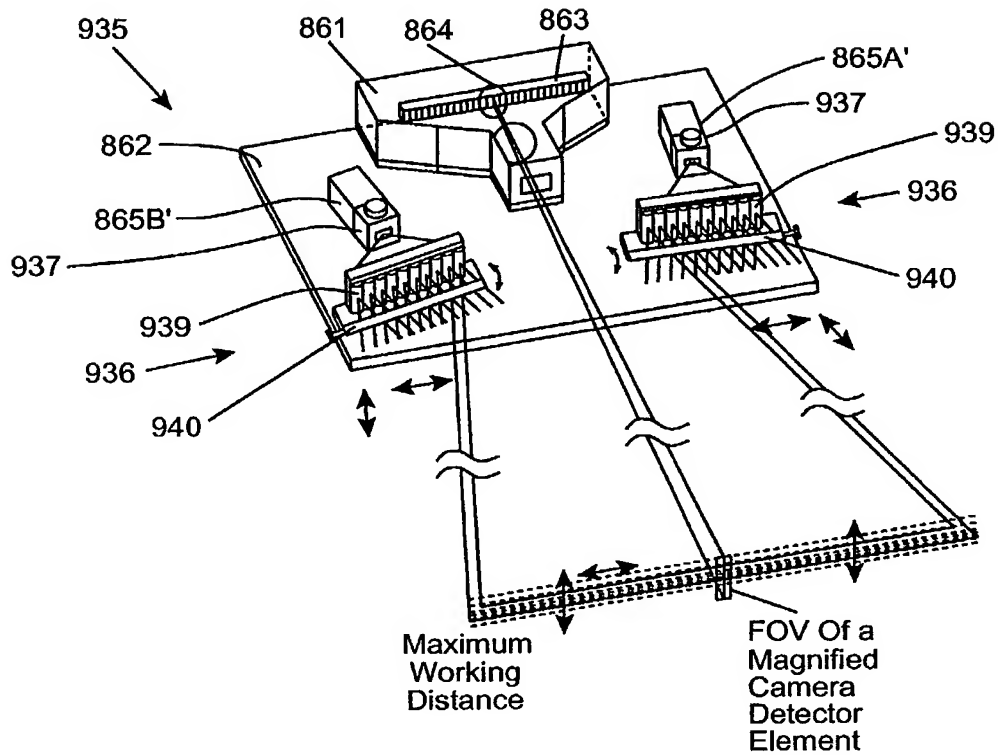
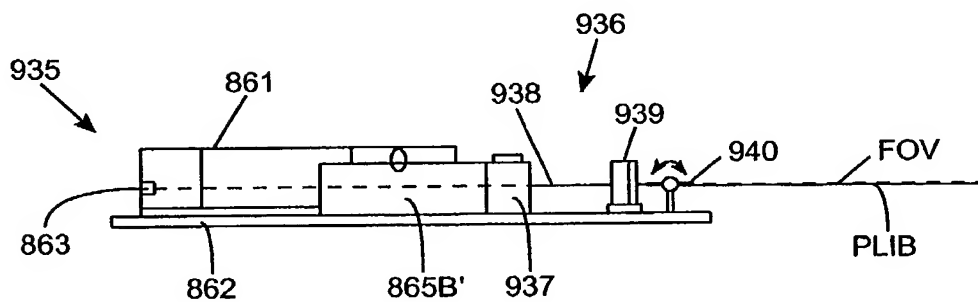


FIG. 1I25G2



\* Lateral And Transverse Micro-oscillation Of PLIB



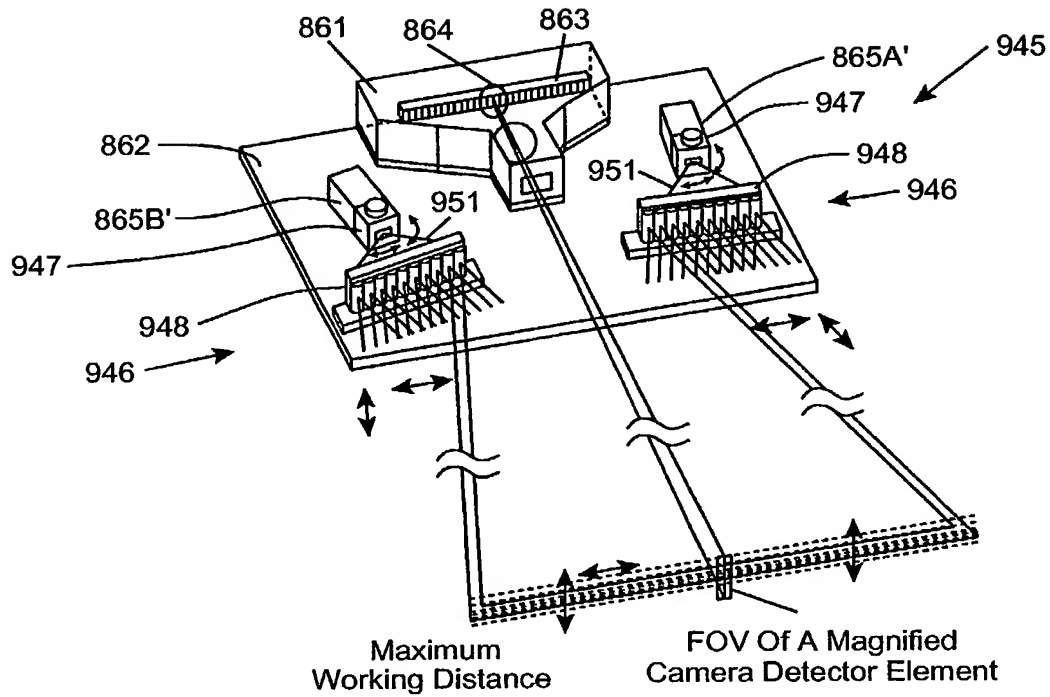


FIG. 1125I1

\* Lateral And Transverse Micro-oscillation Of PLIB

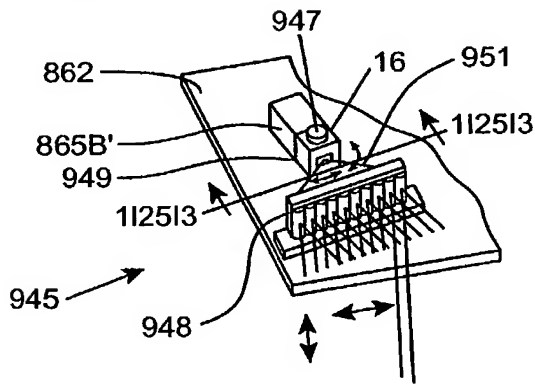


FIG. 1125I2

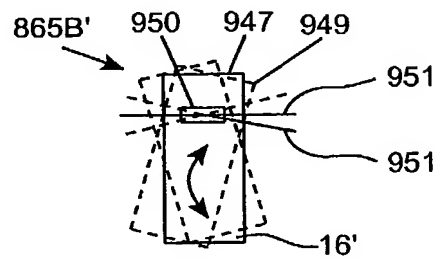


FIG. 1125I3

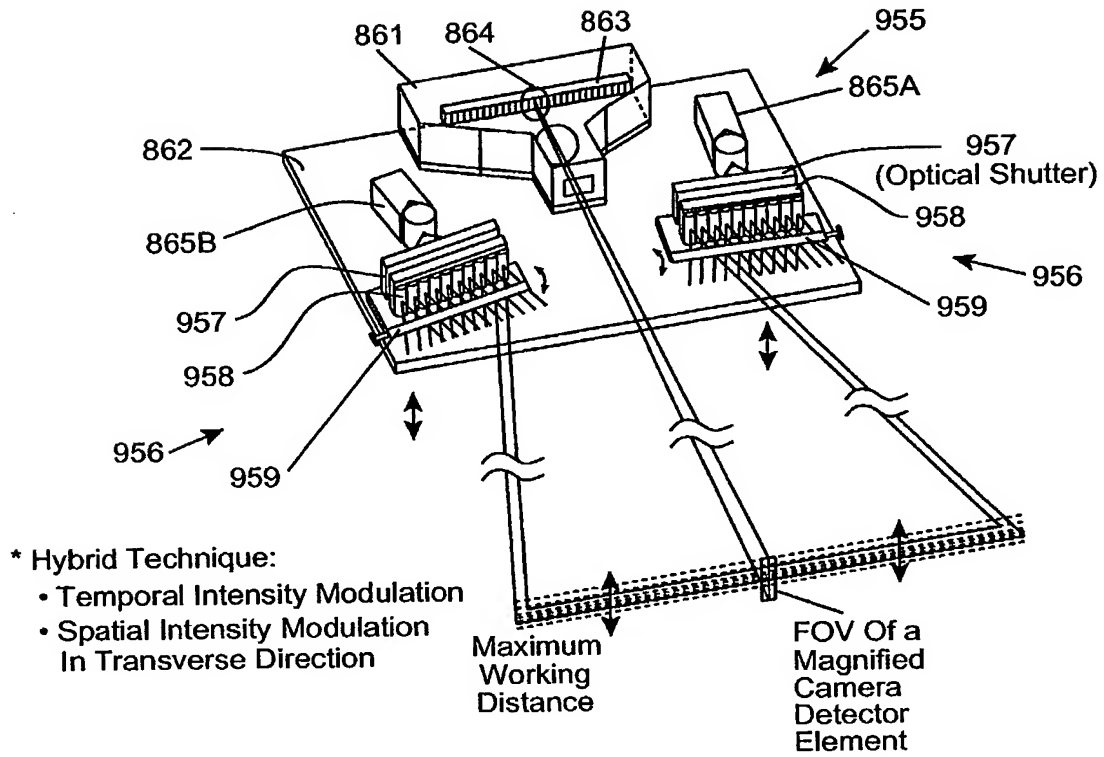


FIG. 1125J1

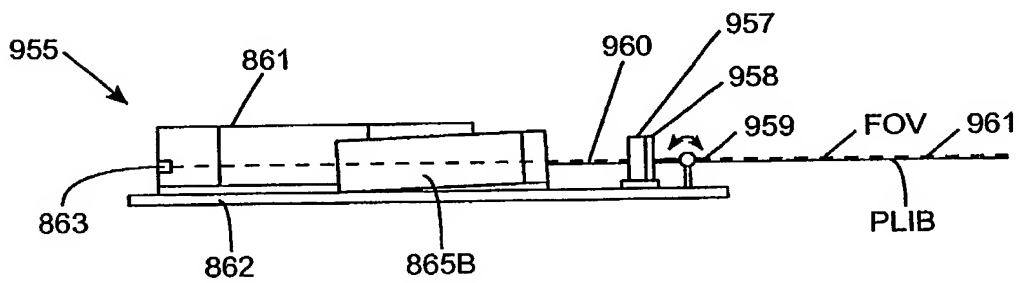


FIG. 1125J2



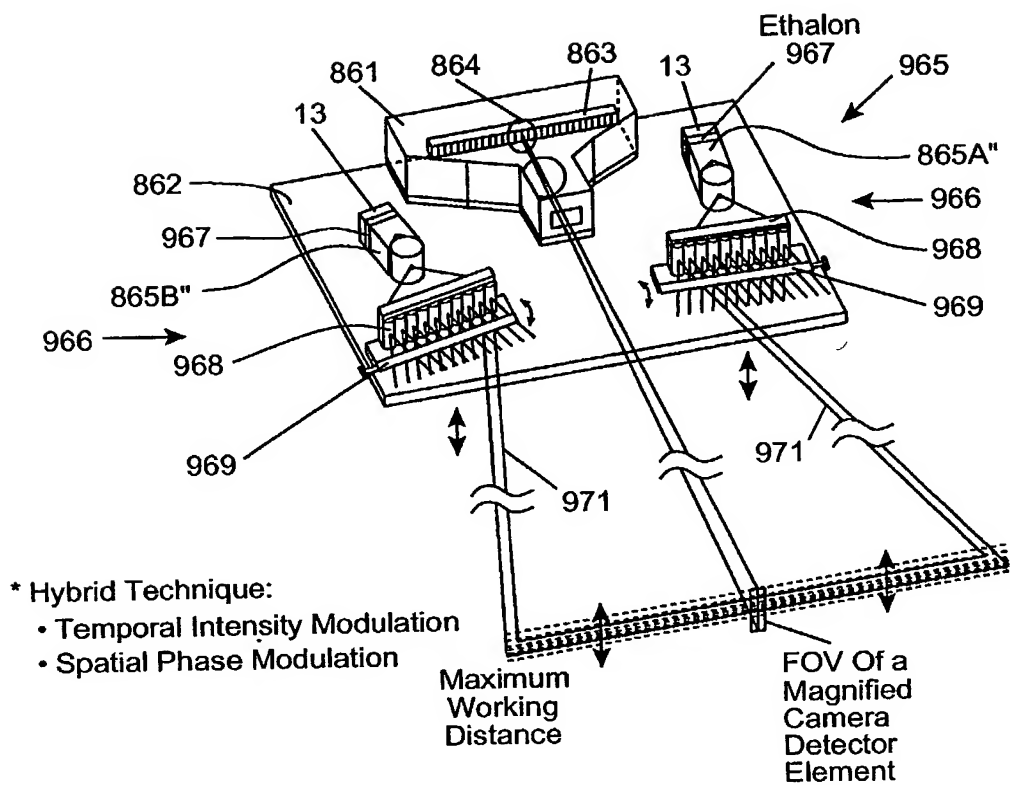


FIG. 1I25K1

\* Transverse Micro-oscillation Of PLIB

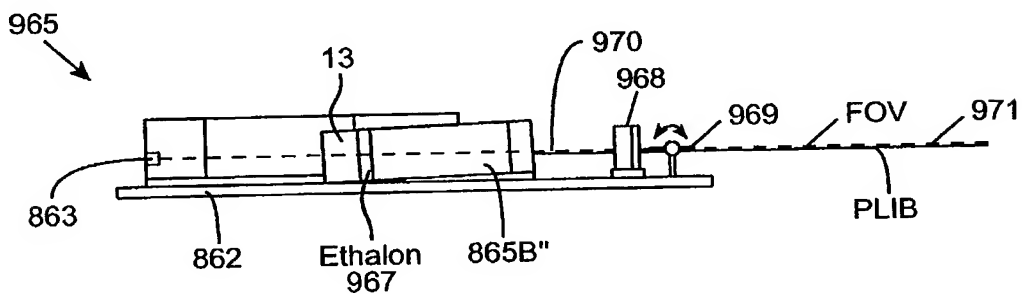
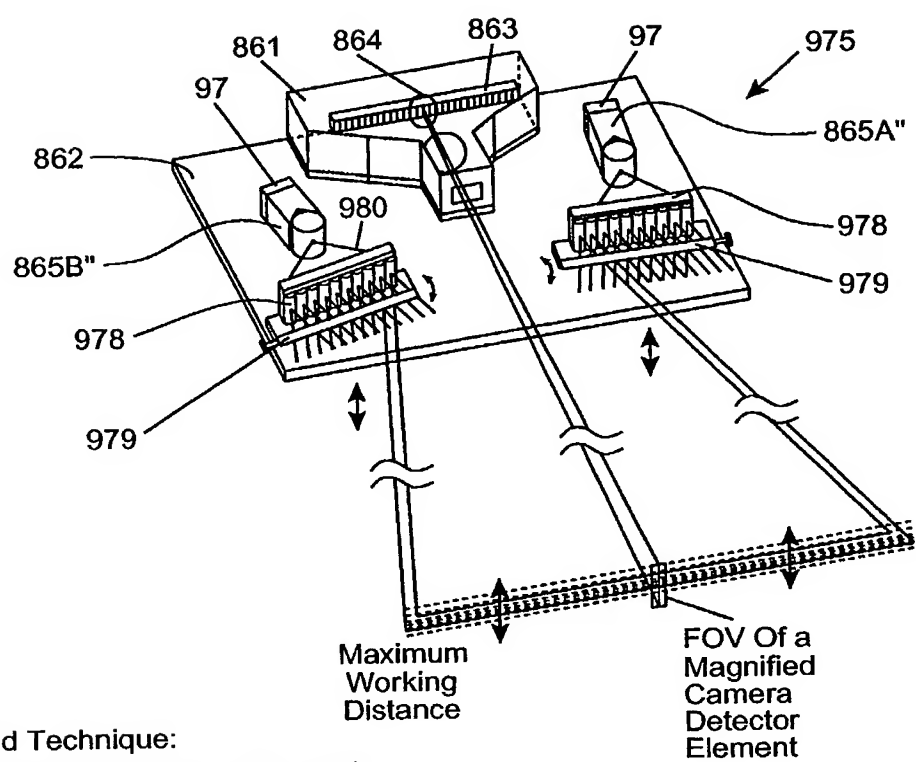


FIG. 1I25K2

20110111



- \* Hybrid Technique:
  - Temporal Frequency Modulation
  - Spatial Phase Modulation

- \* Transverse Micro-oscillation Of PLIB

FIG. 1125L1

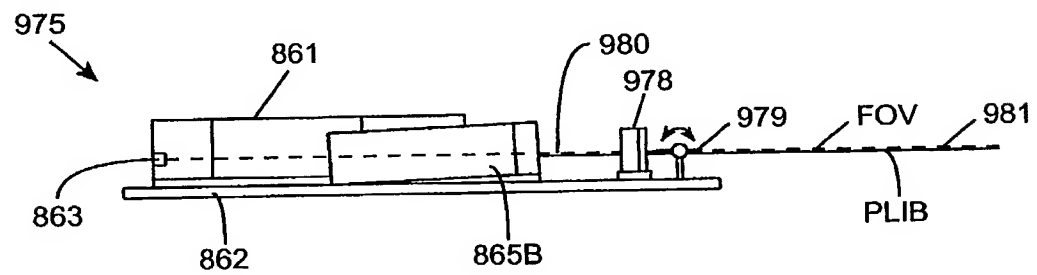
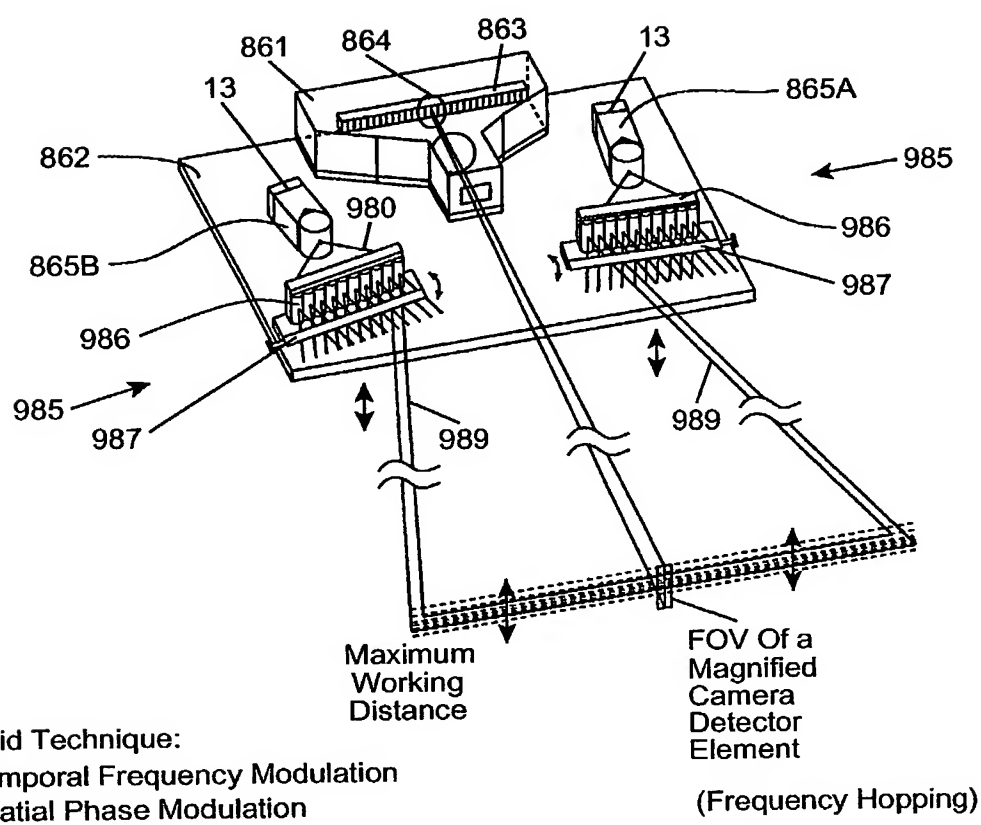


FIG. 1125L2

01/07T



- \* Hybrid Technique:
  - Temporal Frequency Modulation
  - Spatial Phase Modulation

FIG. 1125M1

- \* Transverse Micro-oscillation Of PLIB

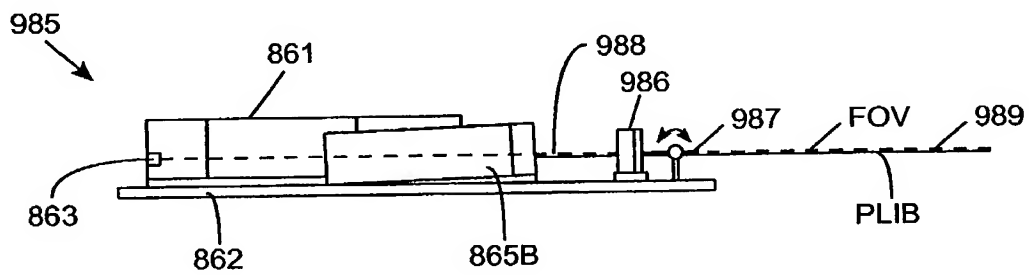


FIG. 1125M2

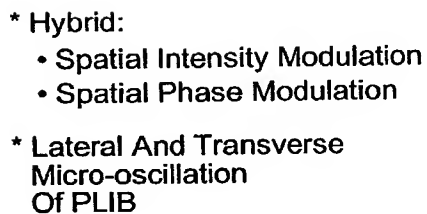


FIG. 1I25N1

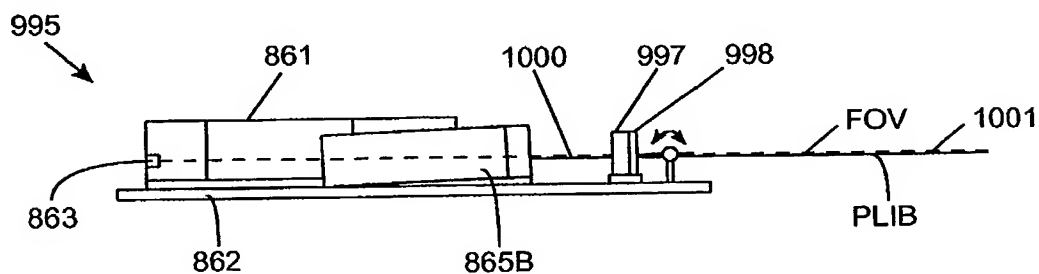


FIG. 1125N2

07/54T

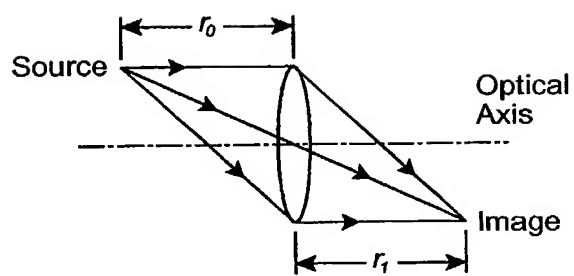


FIG. 1H1

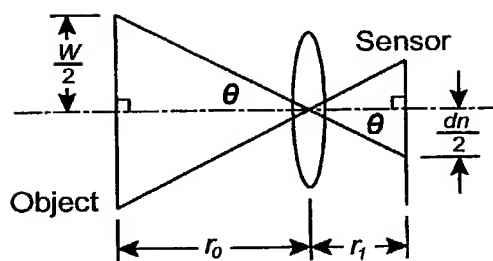


FIG. 1H2

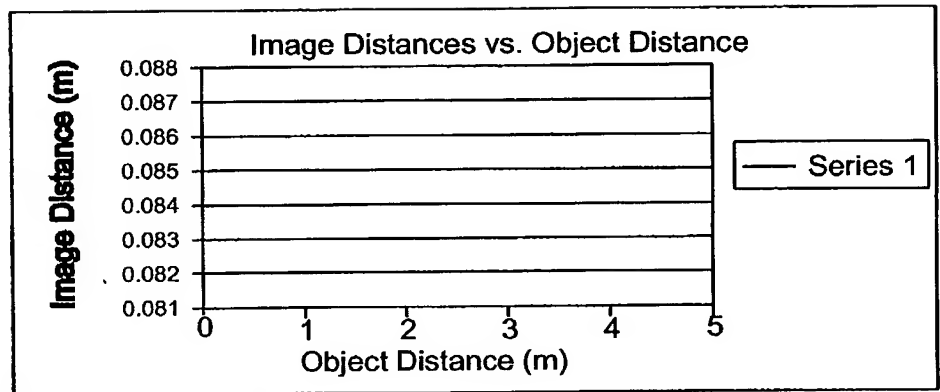


FIG. 1H3

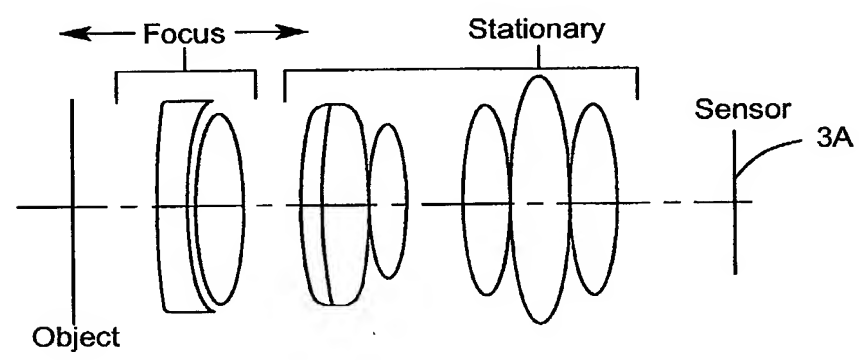


FIG. 1H4

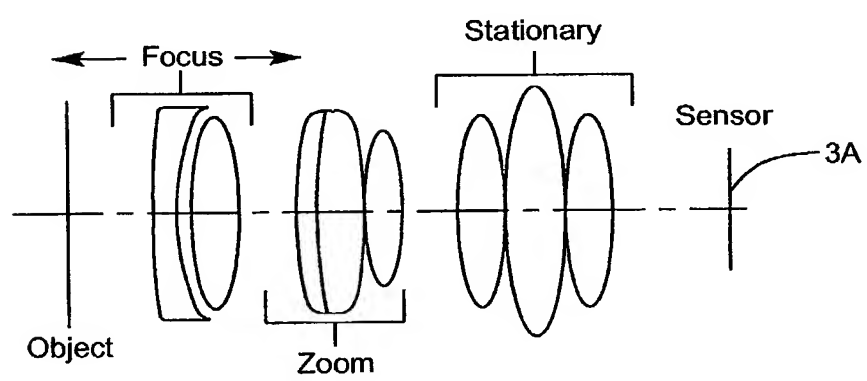


FIG. 1H5

Fixed Focal Length  
Lens Cases

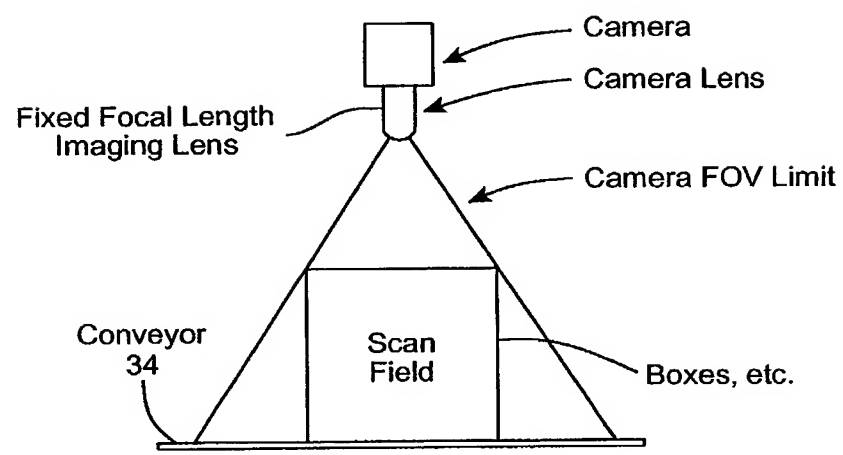


FIG. 1K1

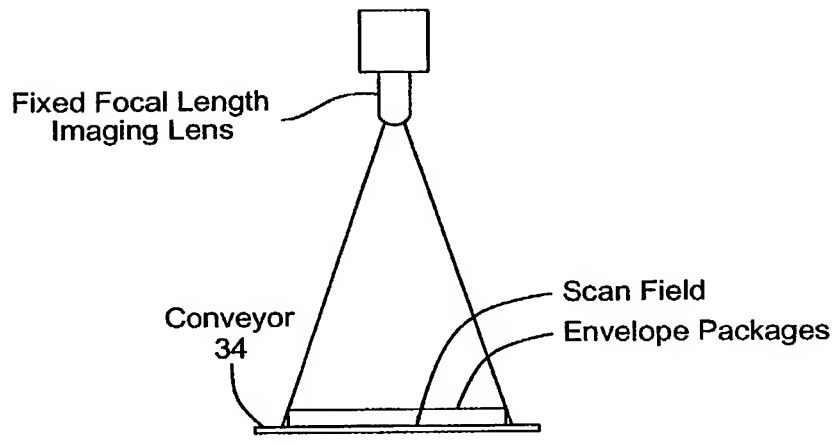


FIG. 1K2

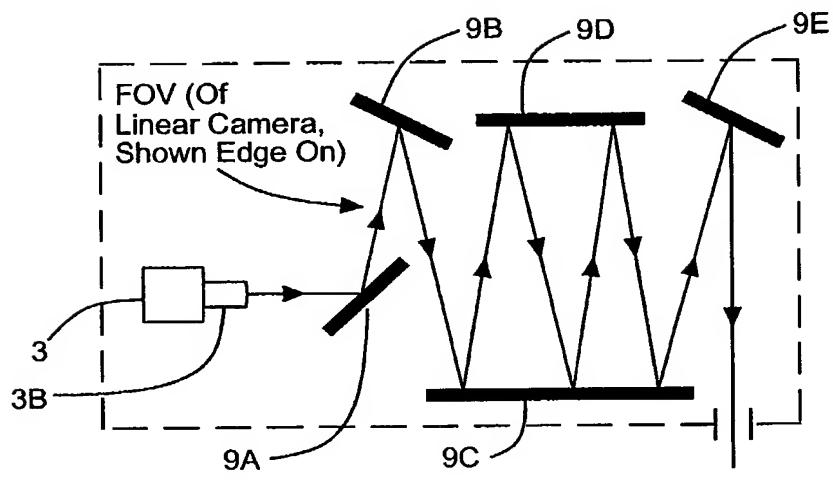


FIG. 1L1

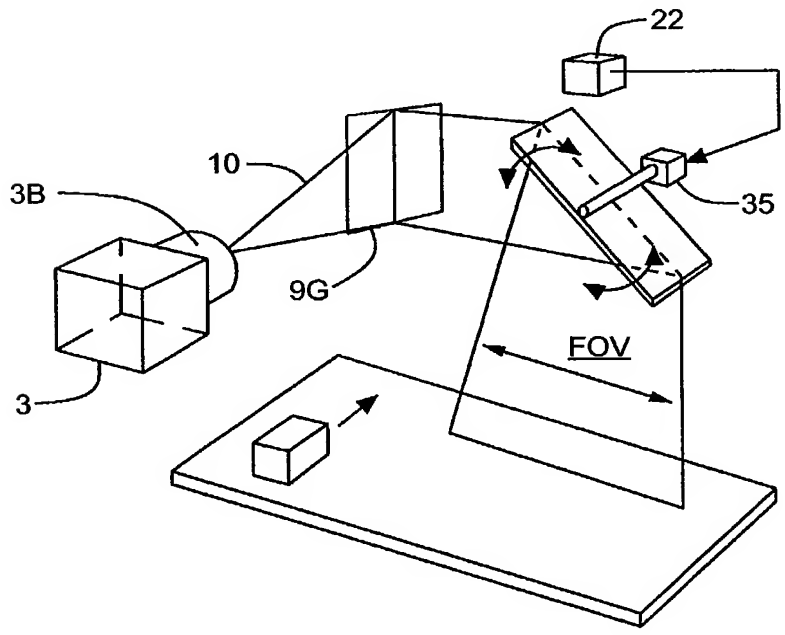


FIG. 1L2





Figure 1 is a line graph showing the relationship between Pixel Power Density (W / m²) on the Y-axis and Object Distance (m) on the X-axis. The Y-axis ranges from 0 to 0.030 with major ticks every 0.005. The X-axis ranges from 0.6 to 1.6 with major ticks every 0.1. The data points, represented by open squares, show a decreasing trend. A solid line represents a fitted curve to the data points.

Object Distance (m)	Pixel Power Density (W / m²)
0.70	0.0208
0.75	0.0212
0.80	0.0218
0.85	0.0222
0.90	0.0228
0.95	0.0232
1.00	0.0238
1.05	0.0242
1.10	0.0248
1.15	0.0252
1.20	0.0258
1.25	0.0262
1.30	0.0268
1.35	0.0272
1.40	0.0278
1.45	0.0282
1.50	0.0288
1.55	0.0292
1.60	0.0298

FIG. 1M1

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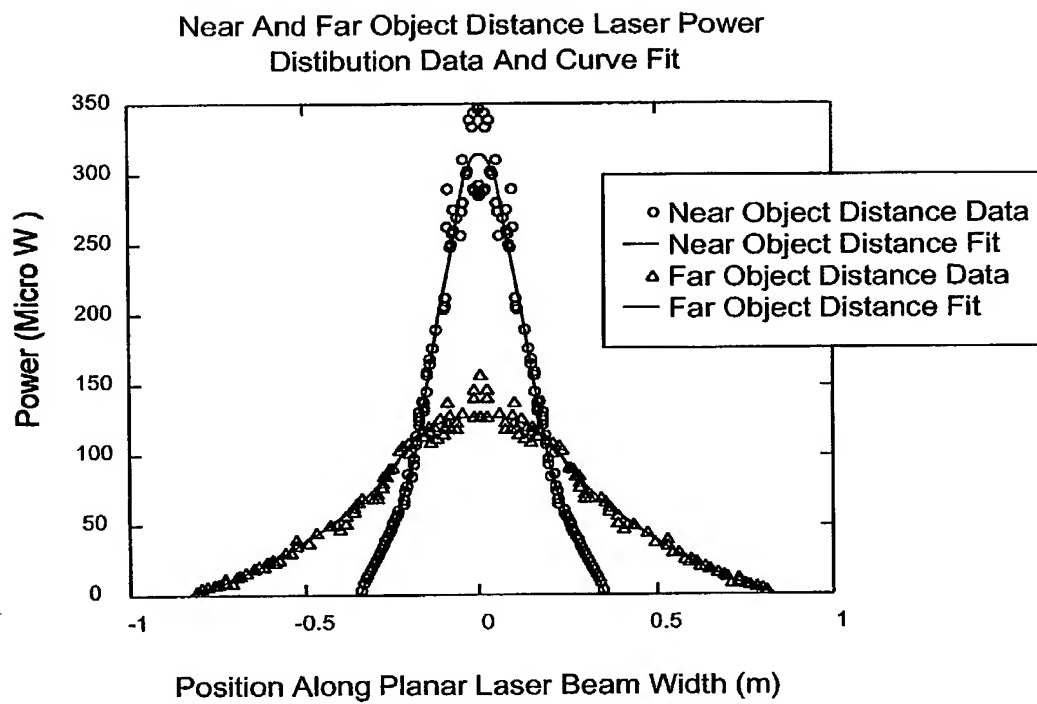


FIG. 1M2

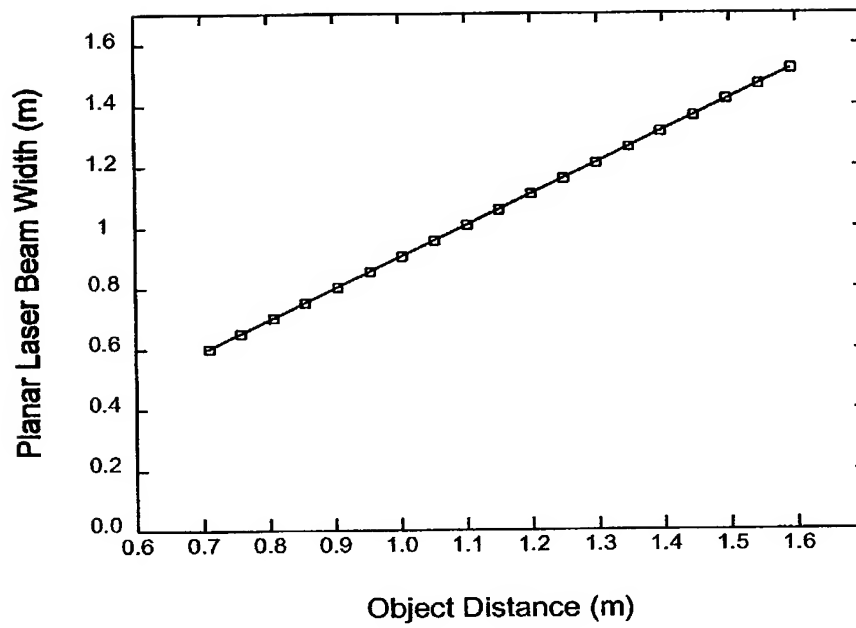


FIG. 1M3

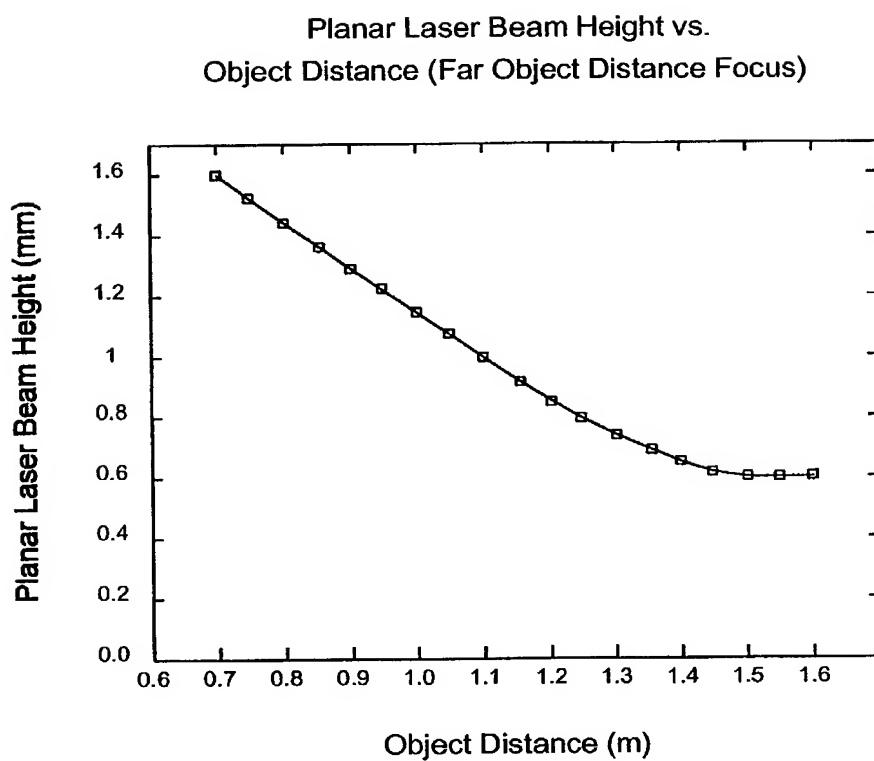
[illegible]

FIG. 1M4

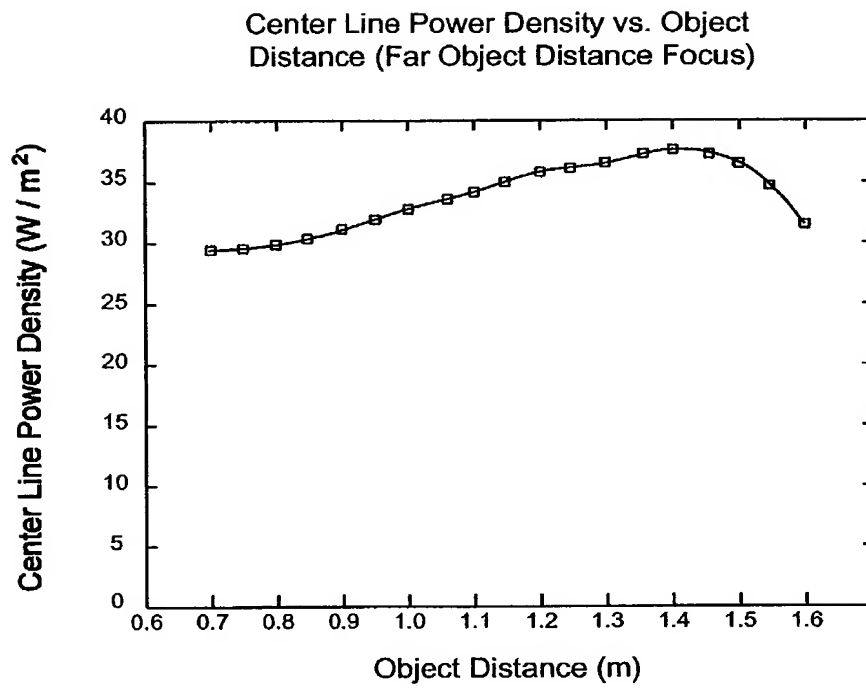


FIG. 1N

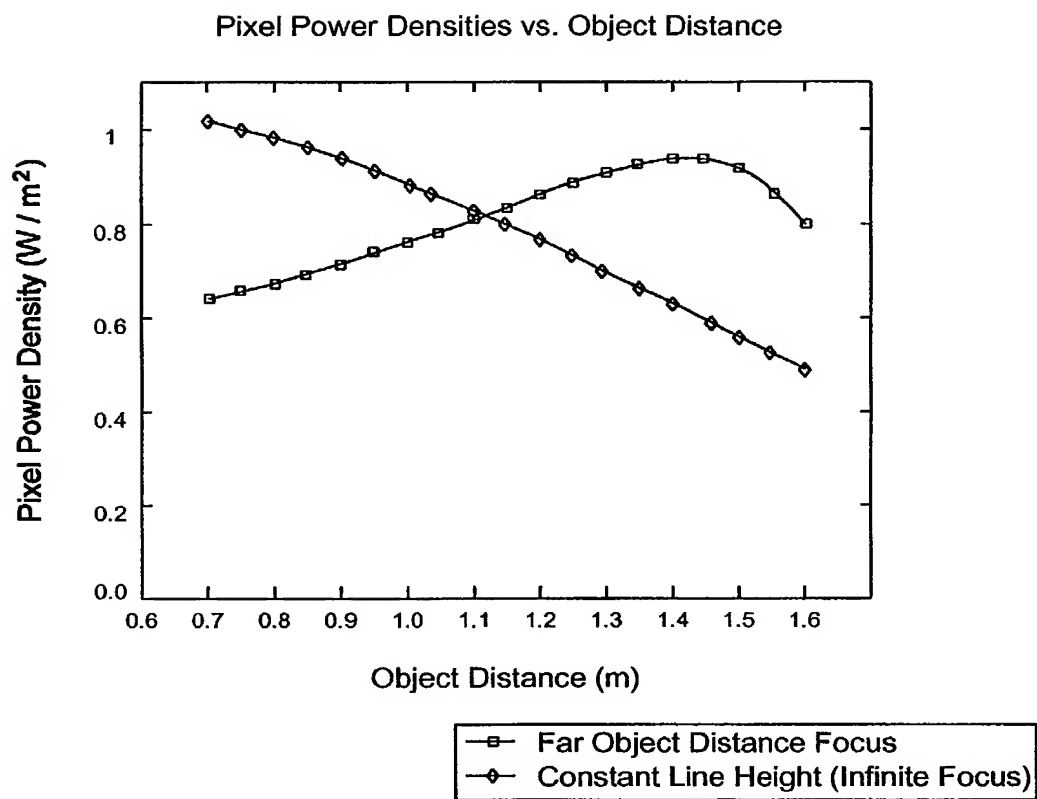
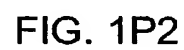


FIG. 10



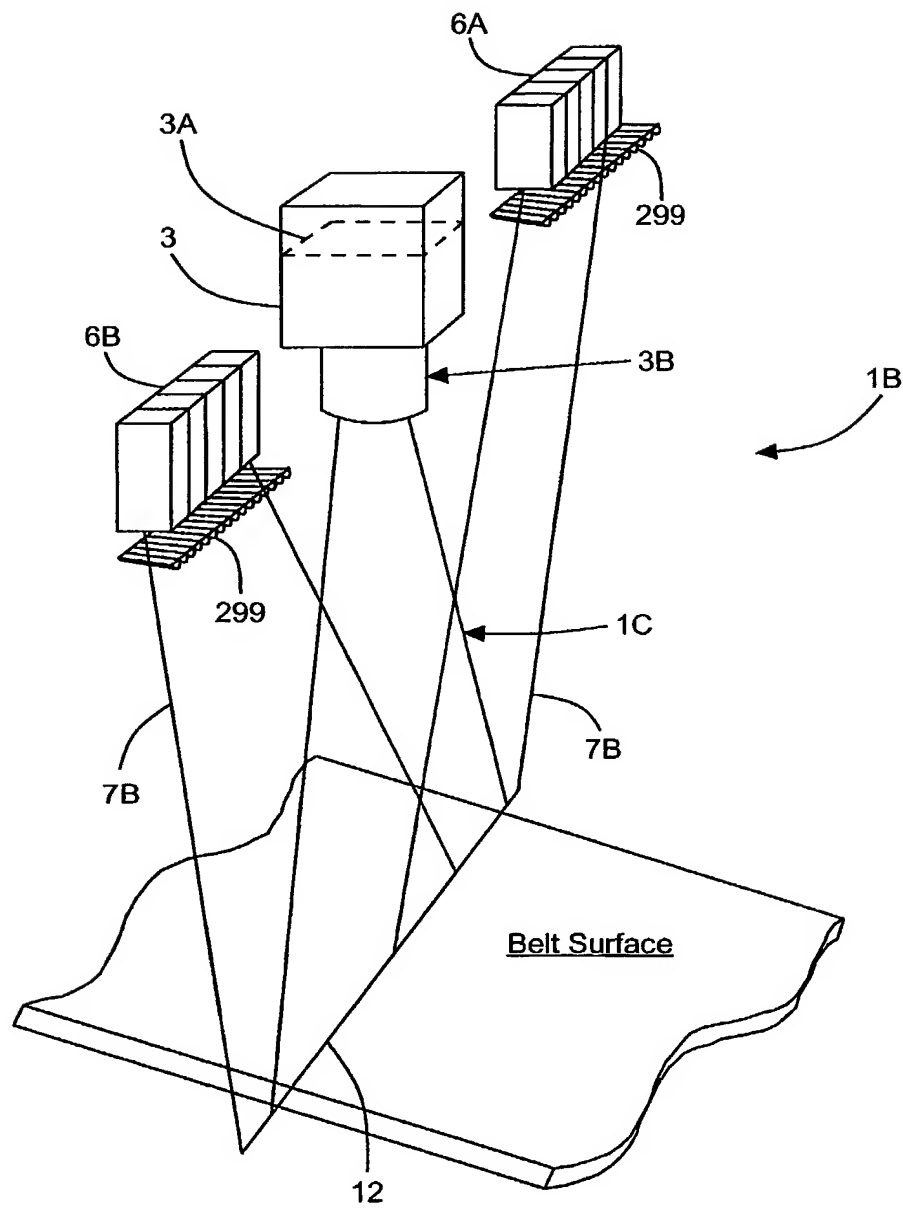


FIG. 1Q1



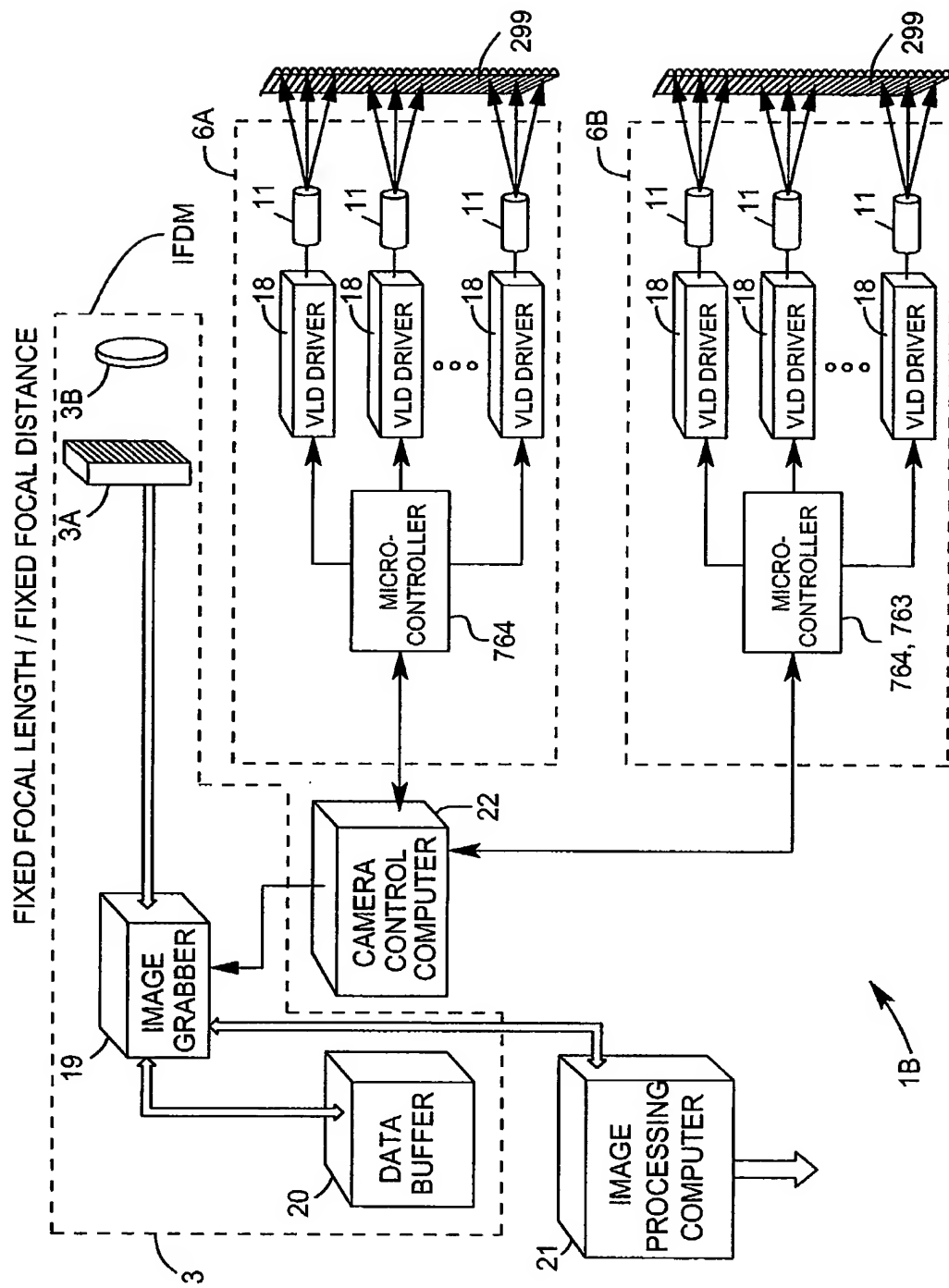


FIG. 1Q2

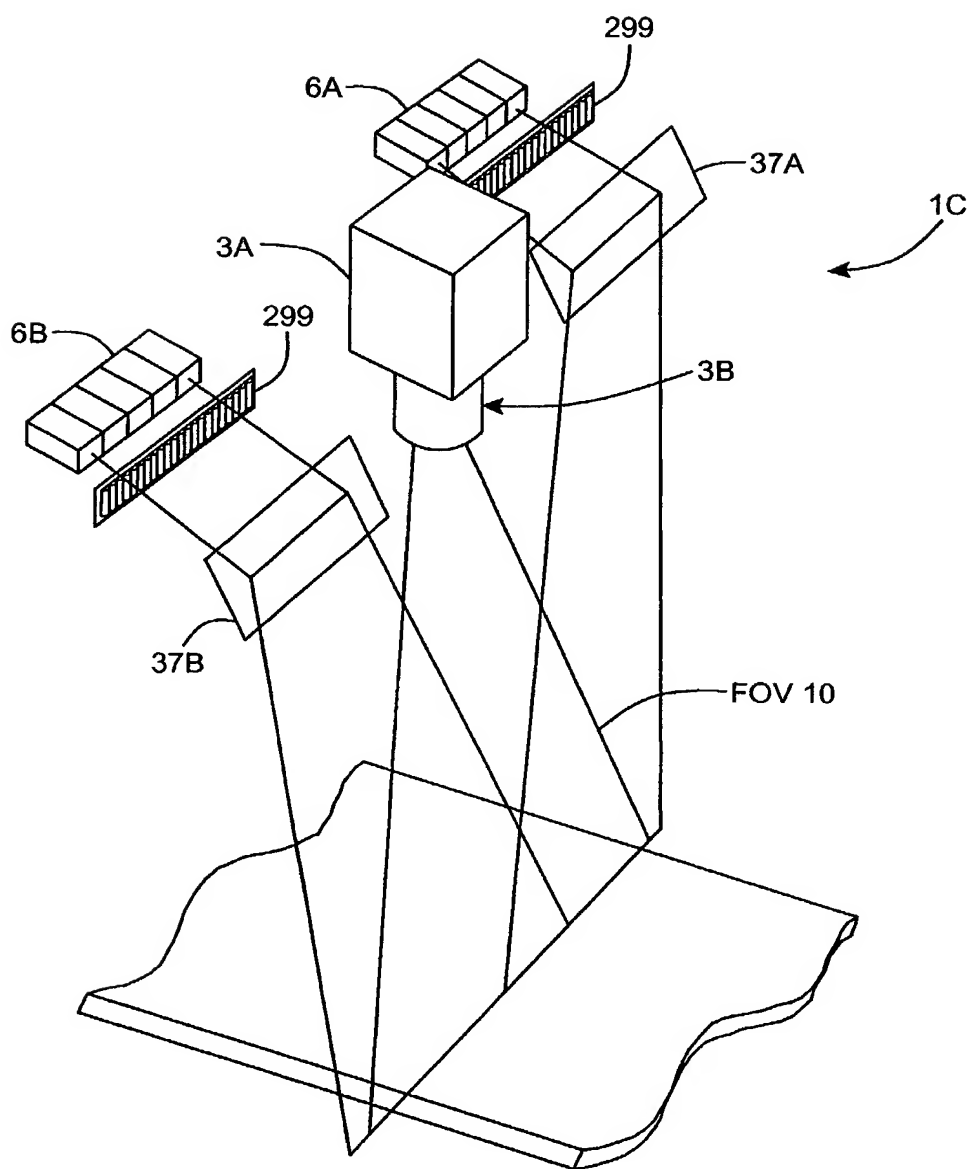


FIG. 1R1

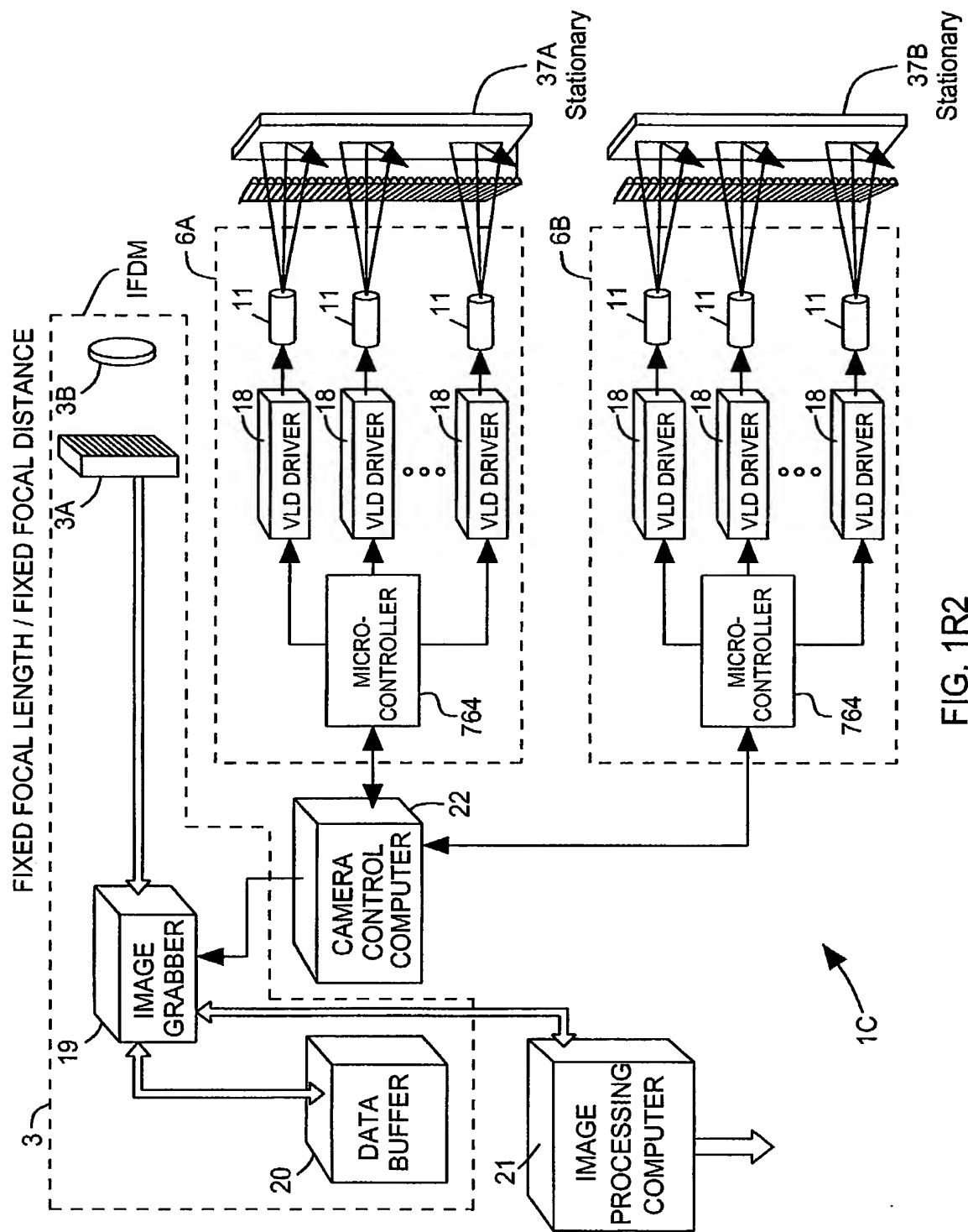


FIG. 1R2

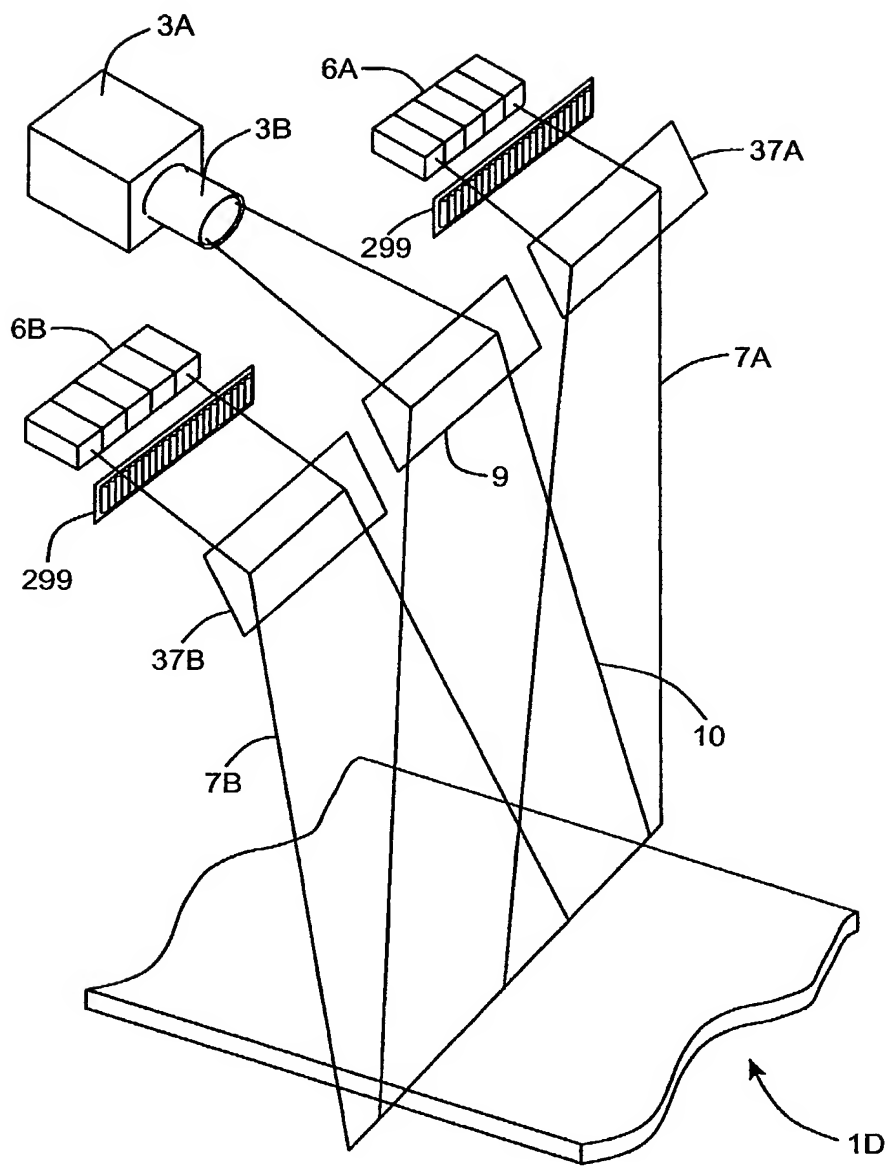


FIG. 1S1



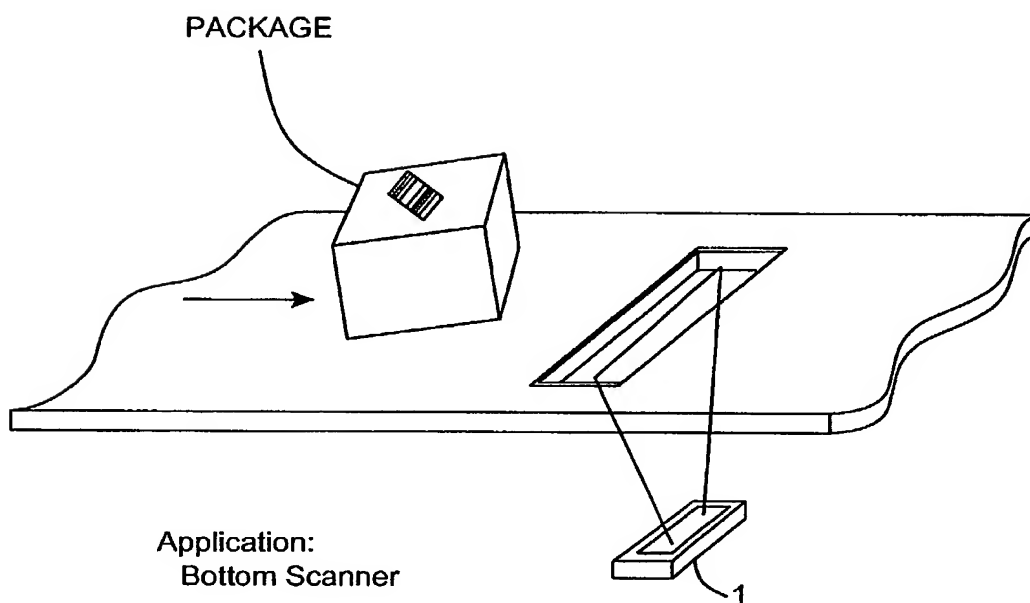
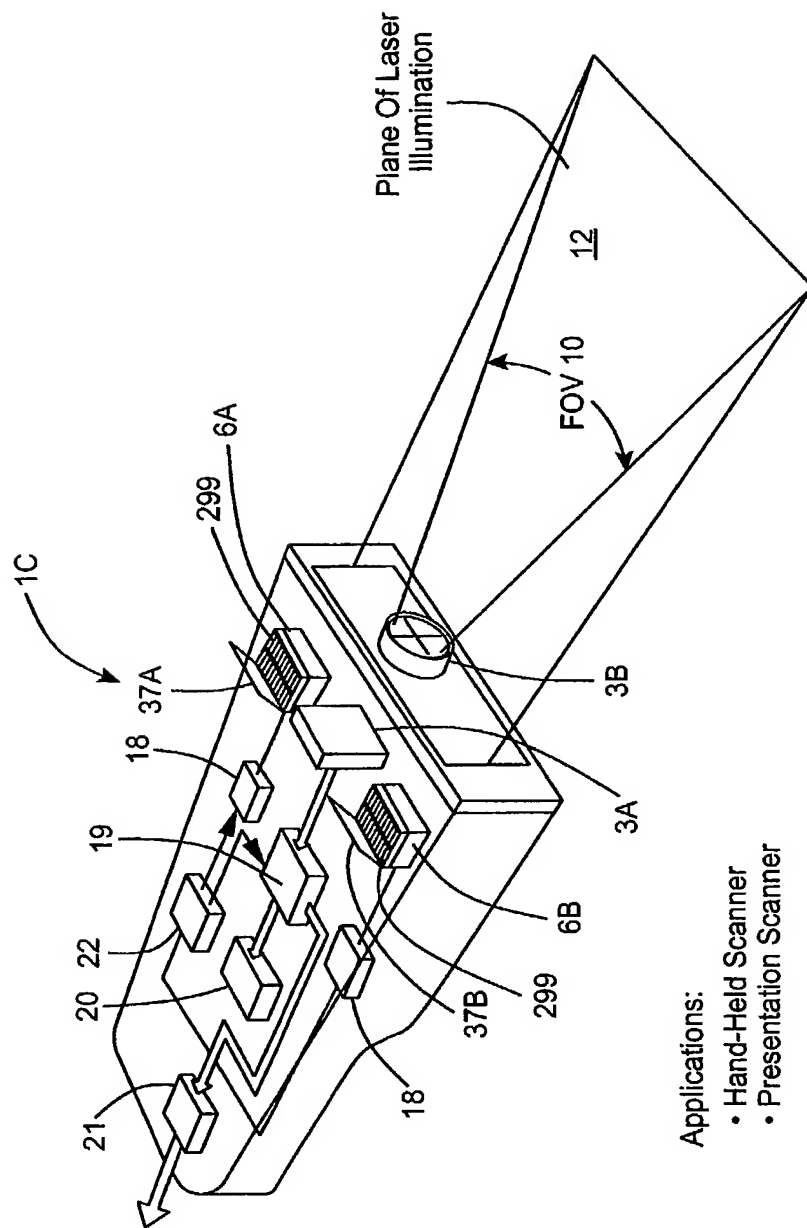


FIG. 1T



Applications:

- Hand-Held Scanner
- Presentation Scanner

FIG. 1U

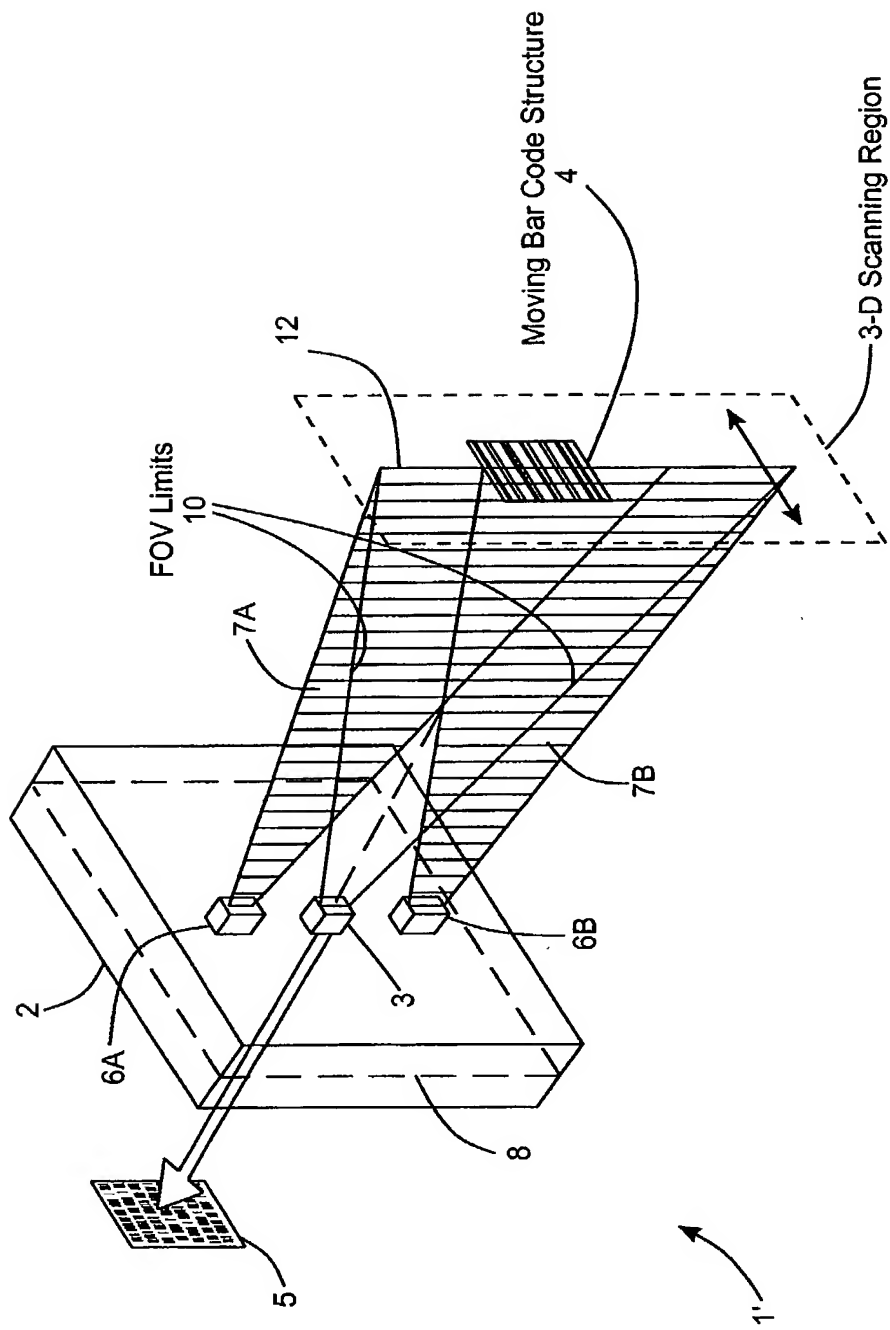


FIG. 1V1



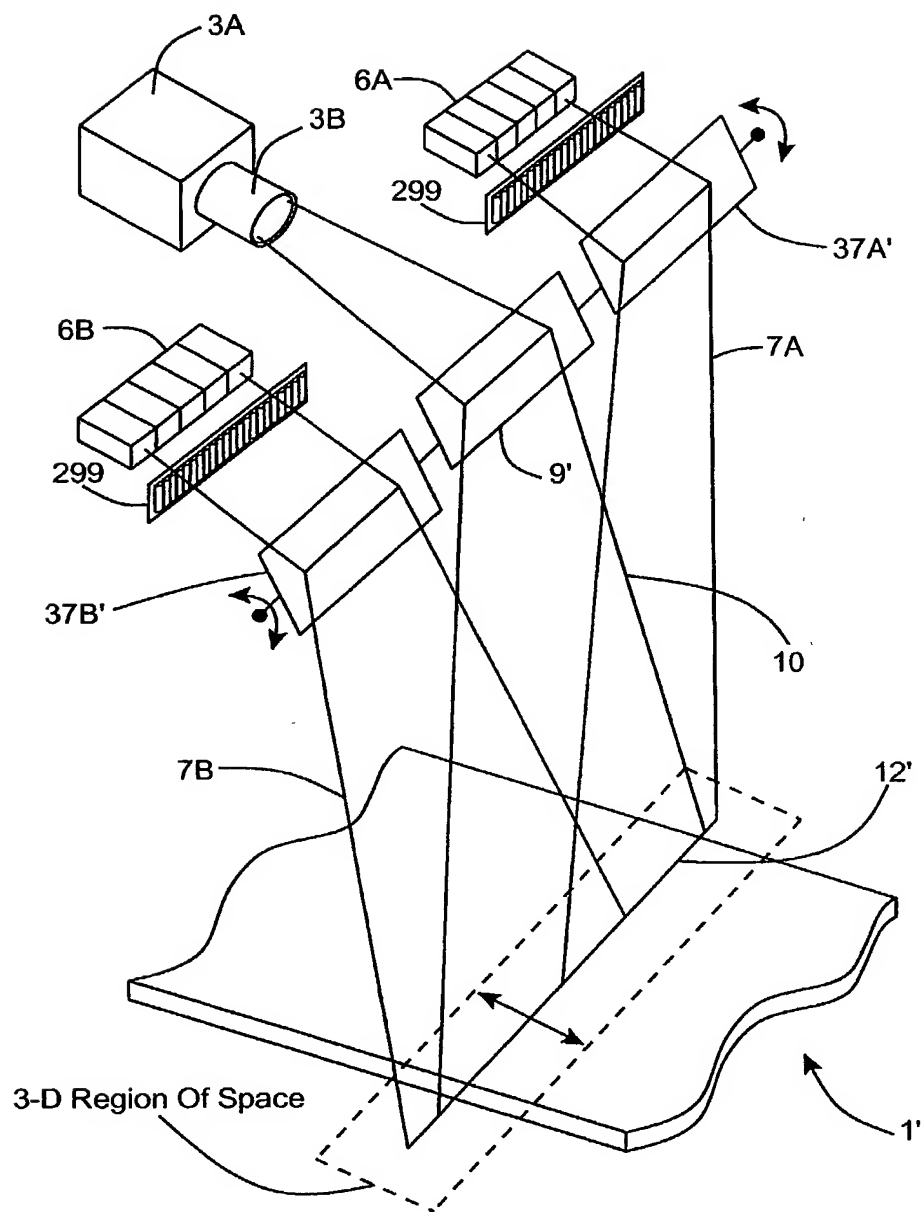


FIG. 1V2,

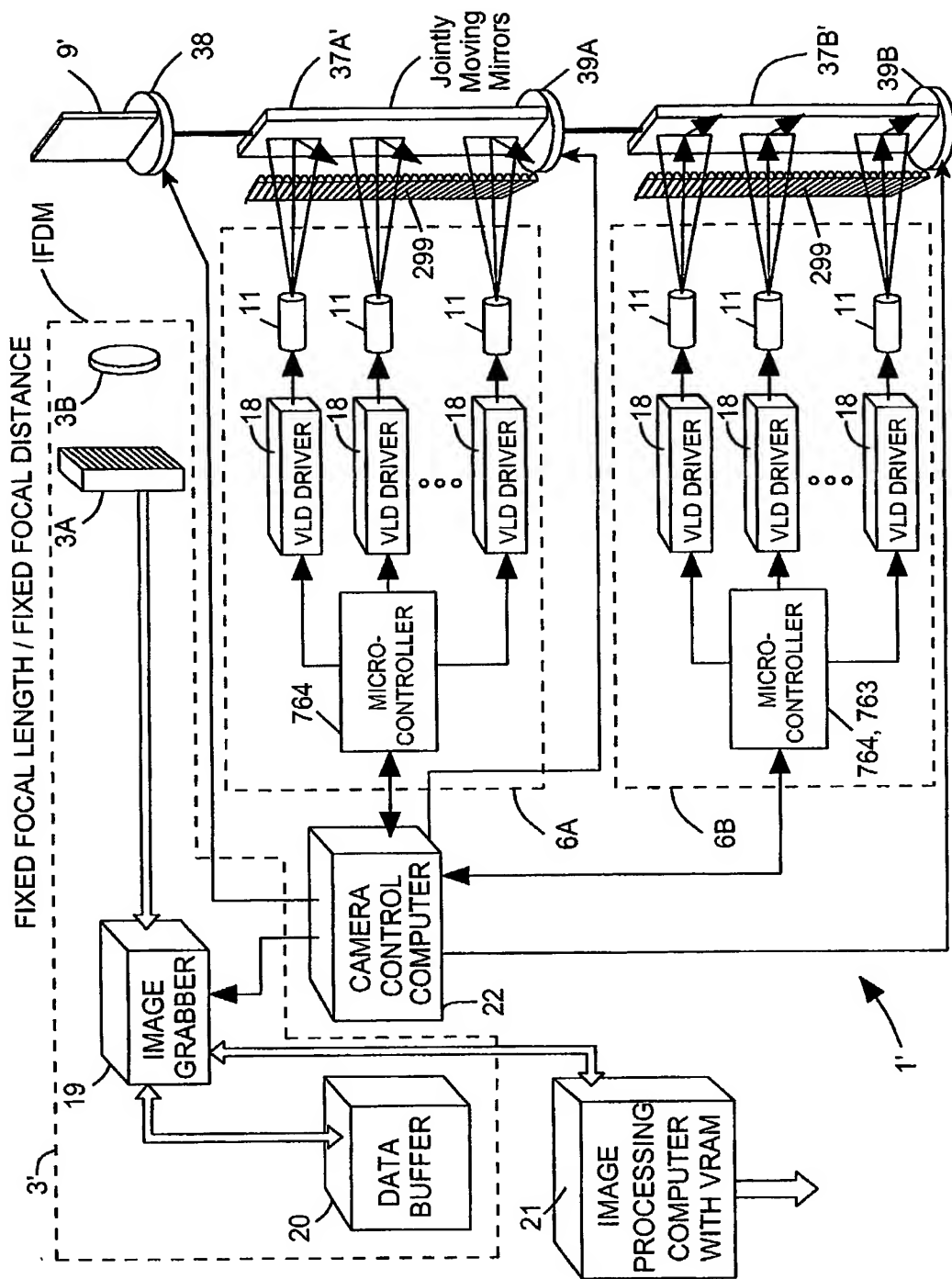


FIG. 1V3



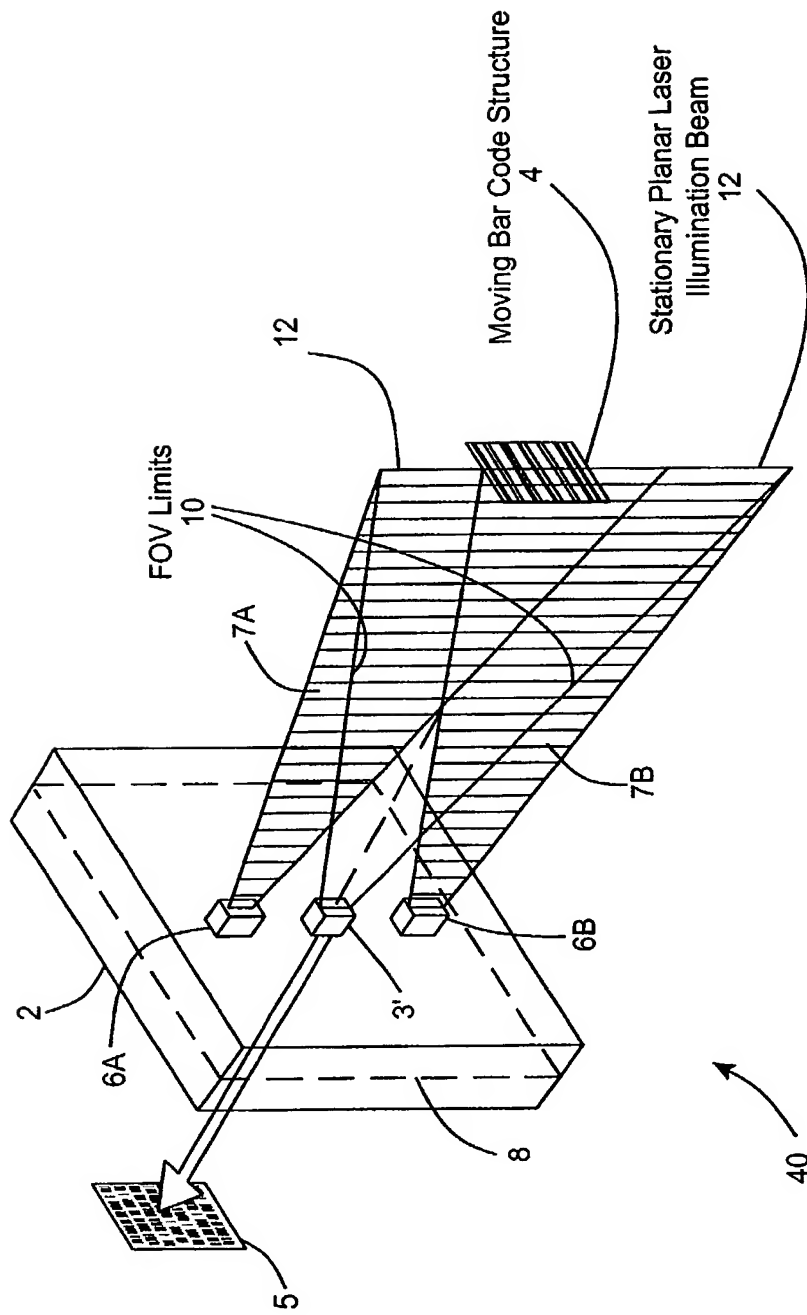


FIG. 2A

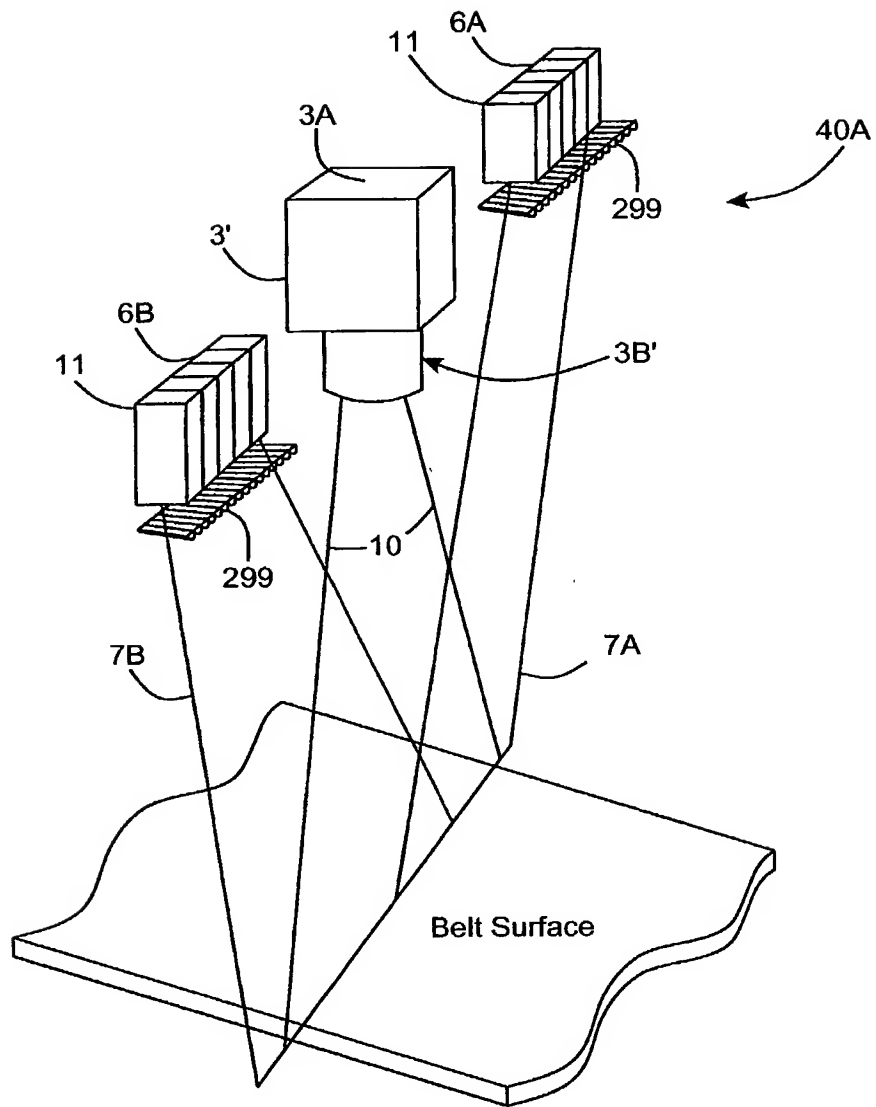


FIG. 2B1

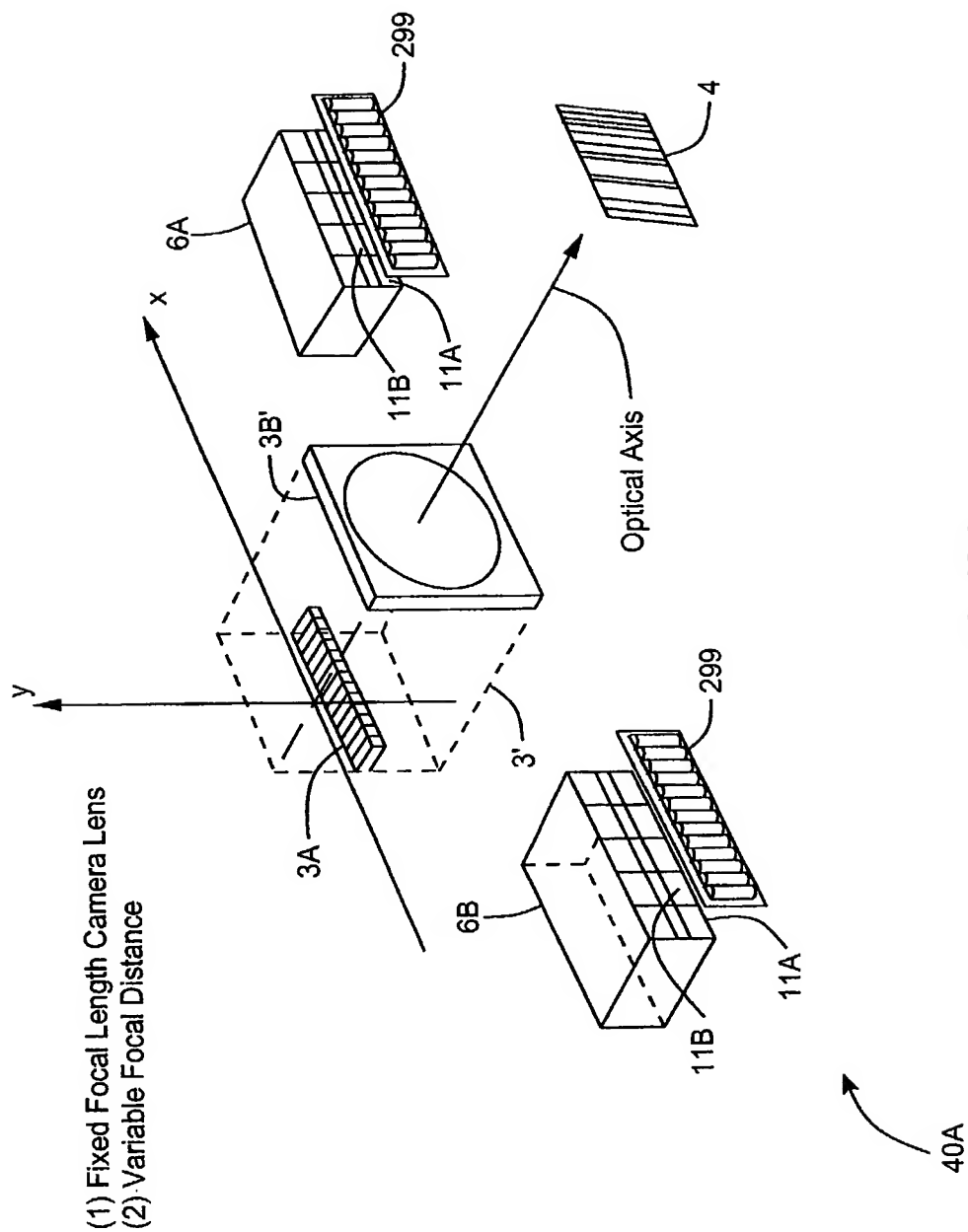


FIG. 2B2

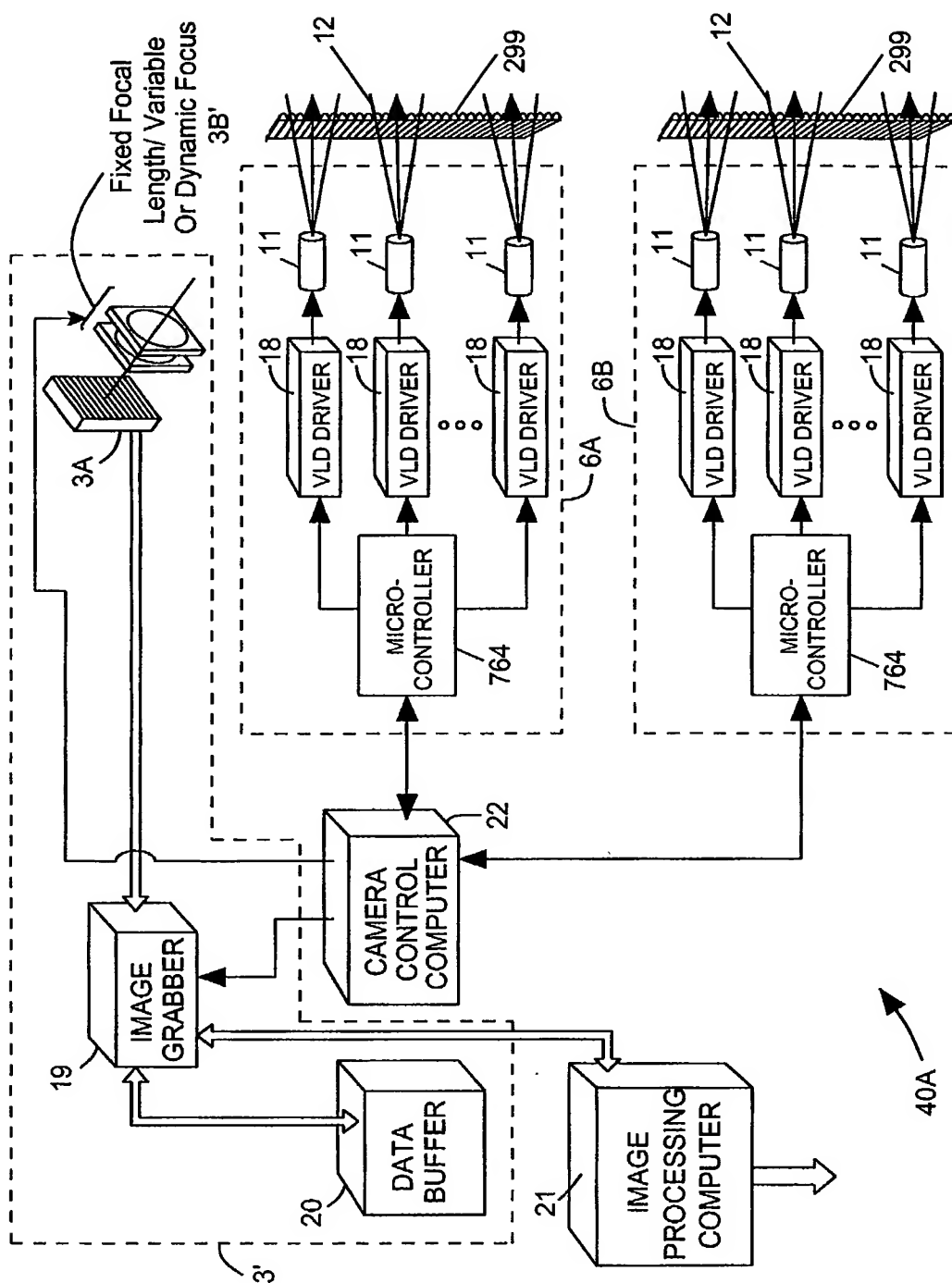
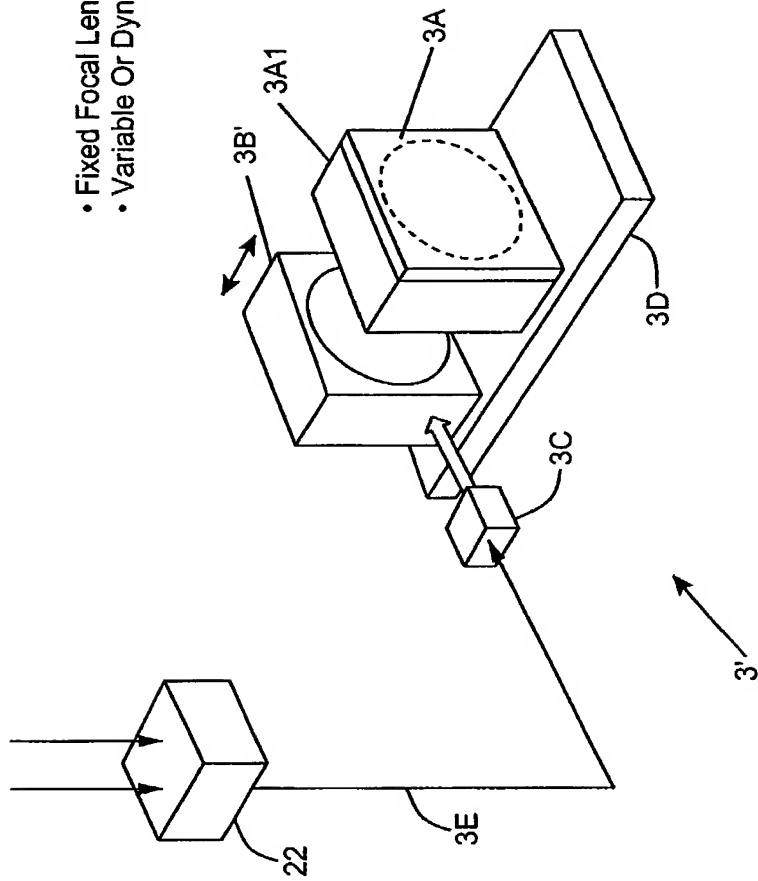


FIG. 2C1



- Fixed Focal Length Imaging Lens
- Variable Or Dynamic Focus Control

FIG. 2C2



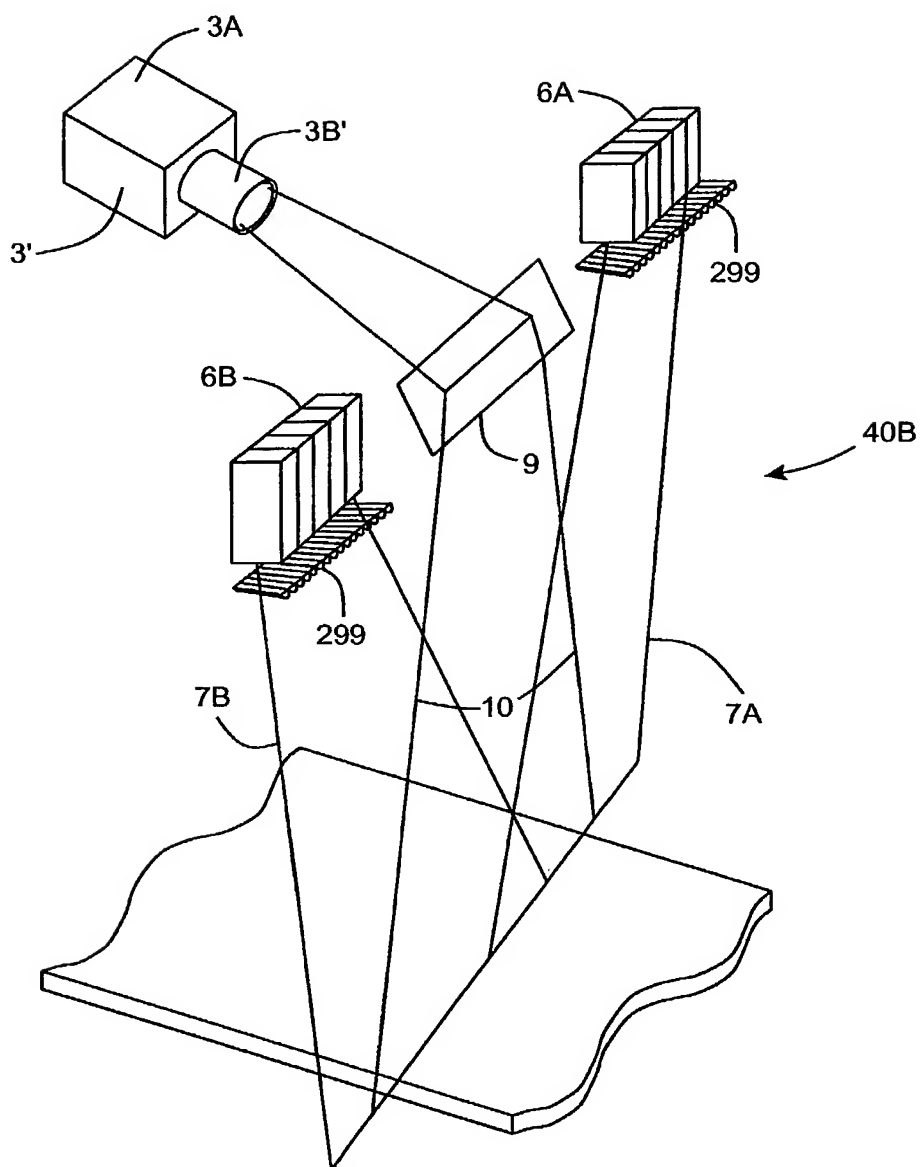


FIG. 2D1

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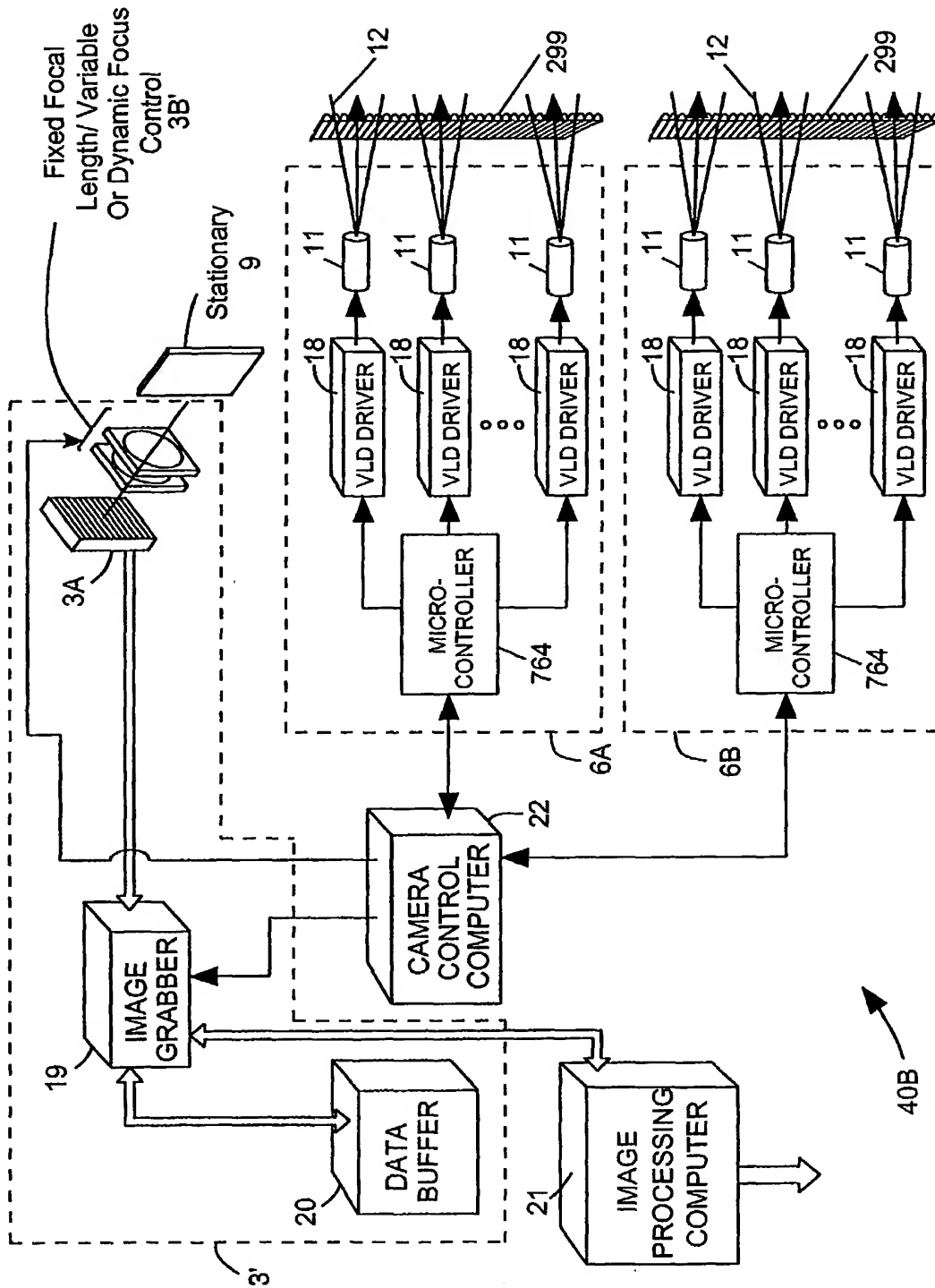
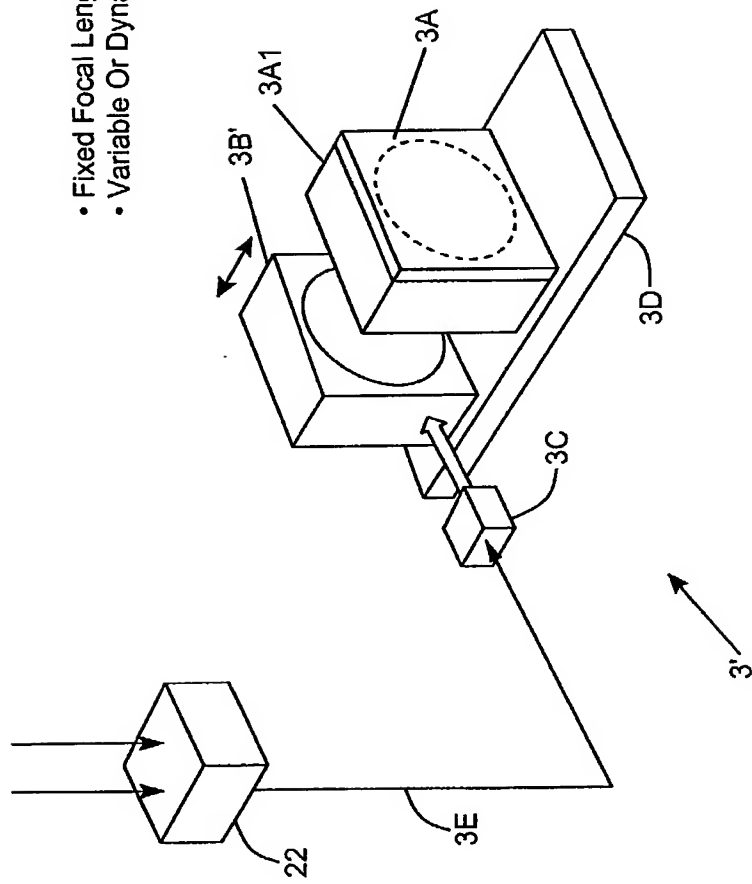


FIG. 2D2



- Fixed Focal Length Imaging Lens
- Variable Or Dynamic Focus Control

FIG. 2D3

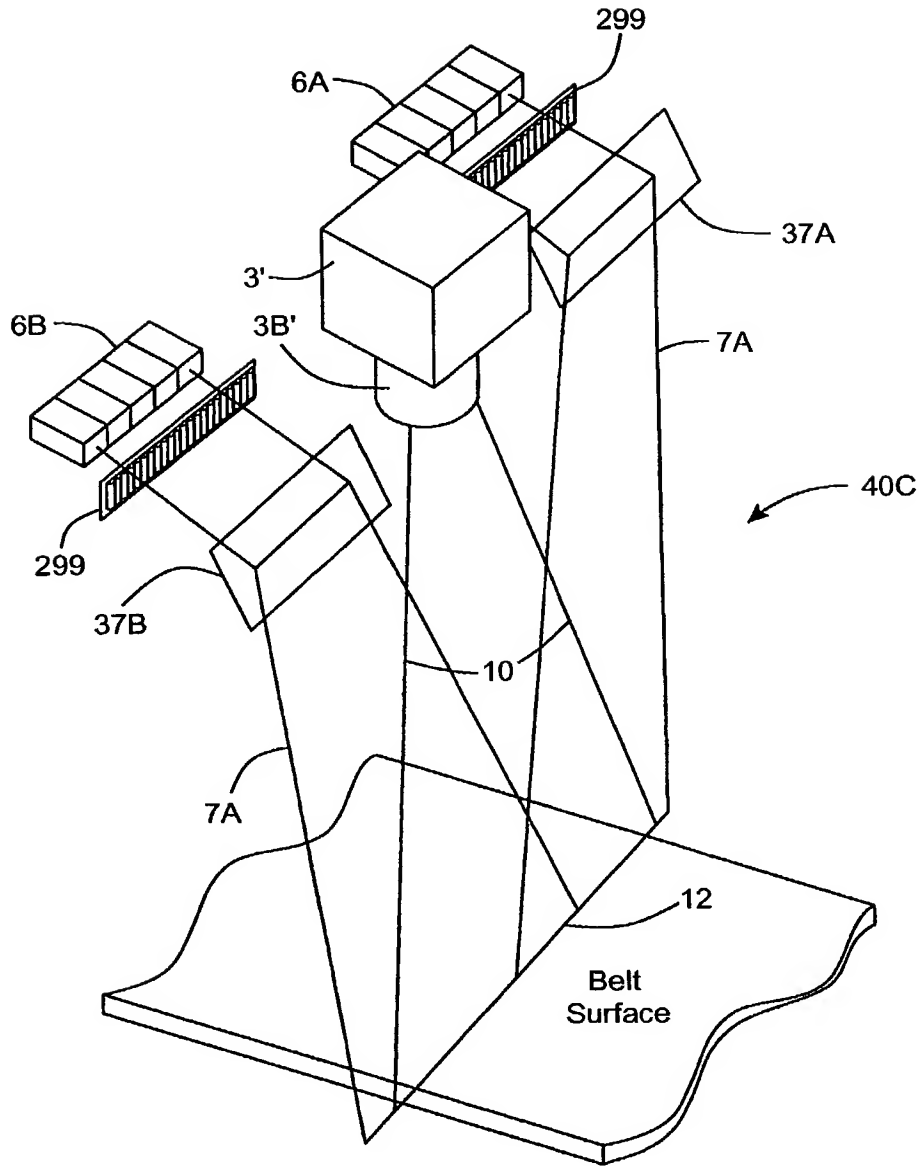


FIG. 2E1

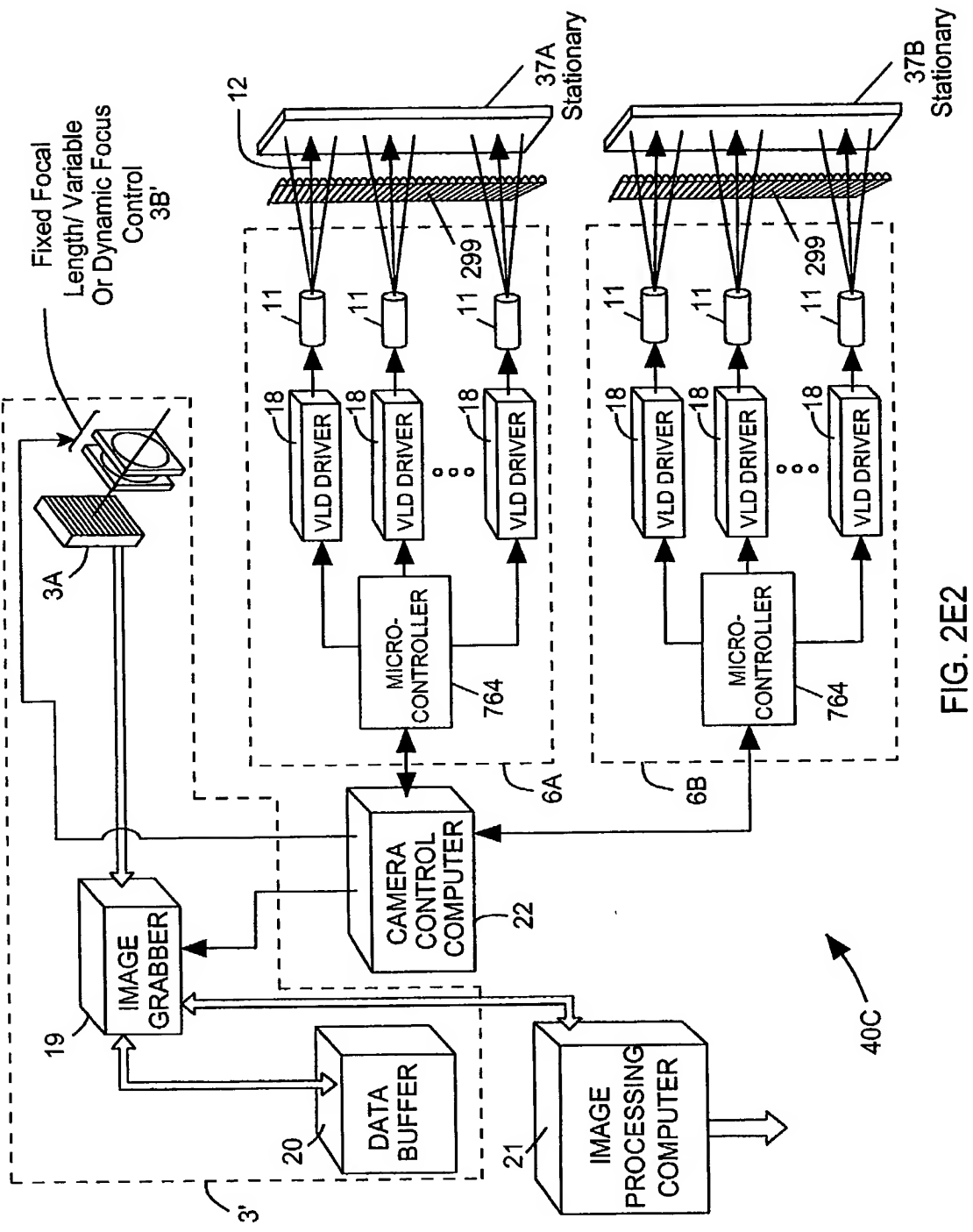


FIG. 2E2

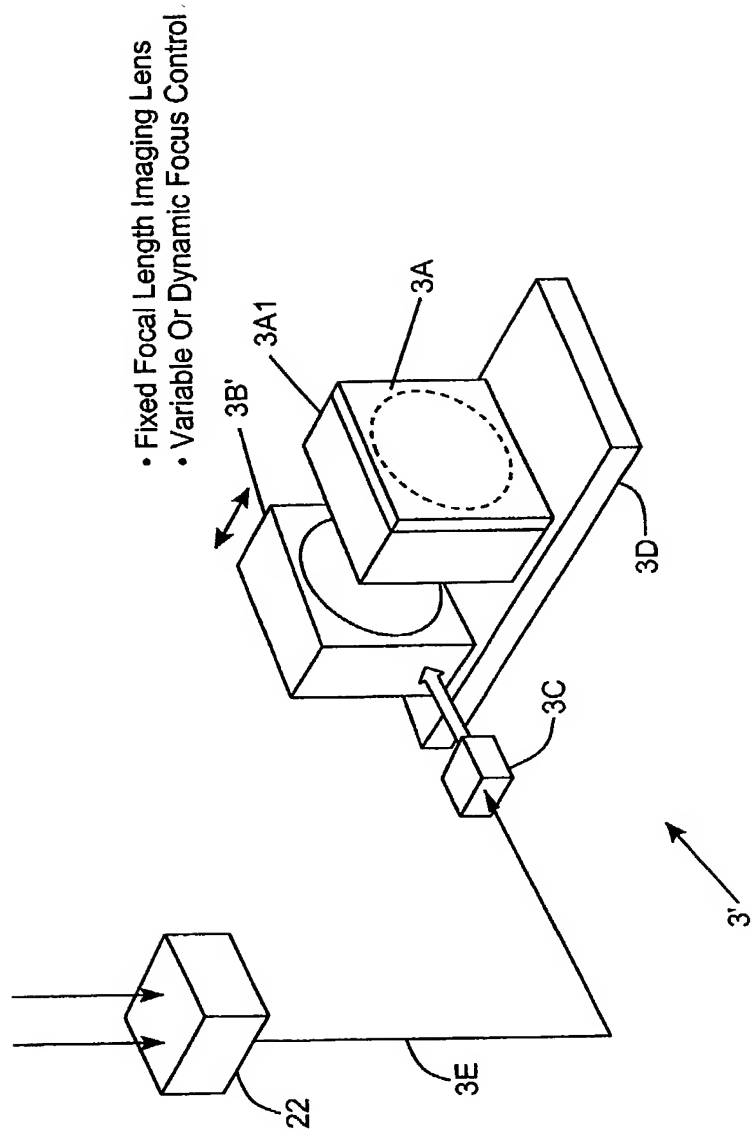


FIG. 2E3

11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

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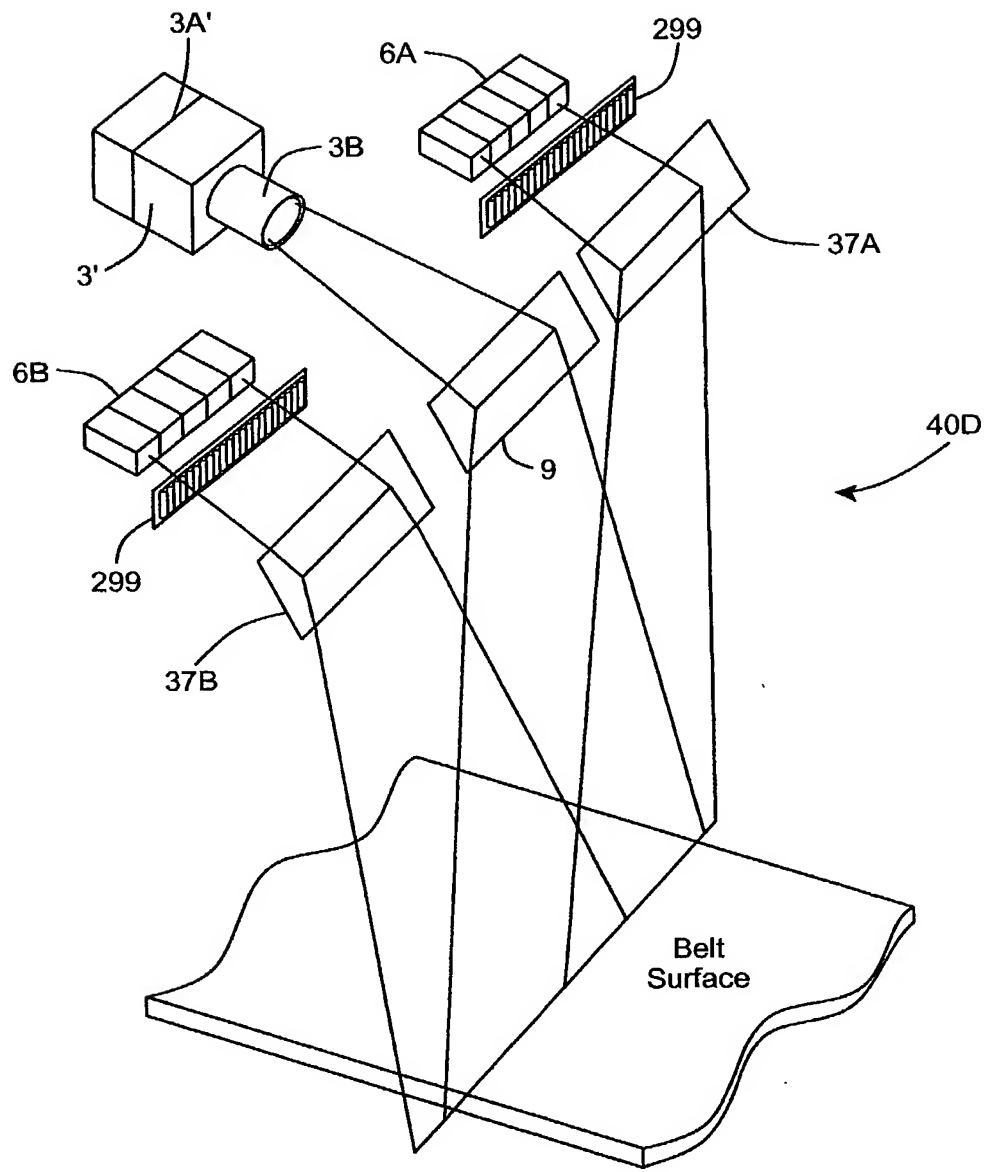


FIG. 2F1

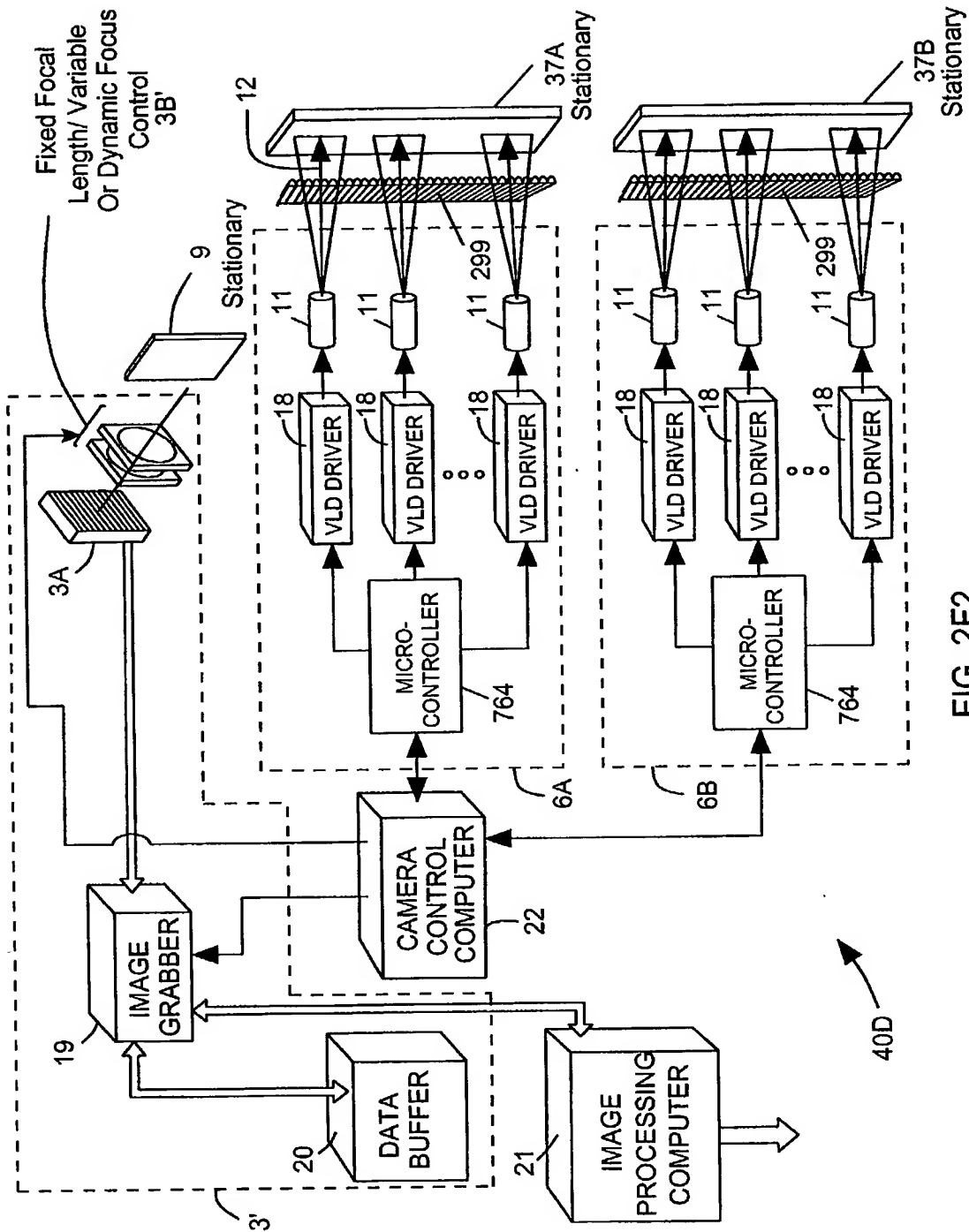


FIG. 2F2



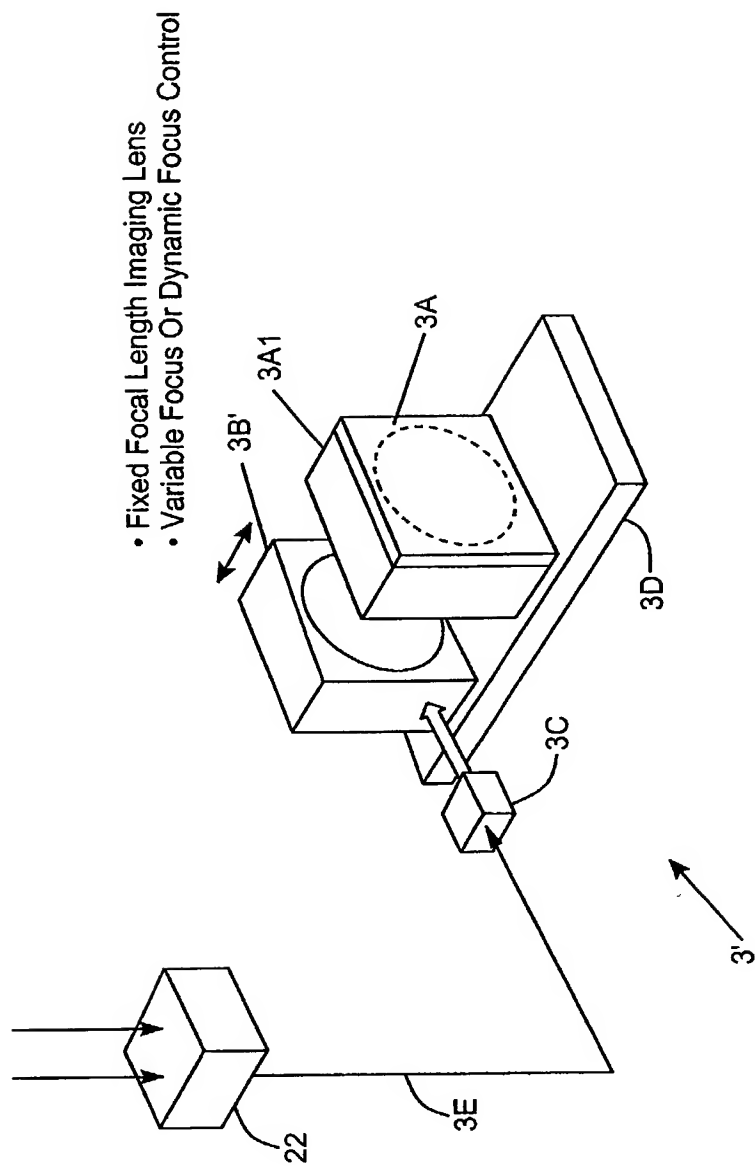


FIG. 2F3

Top Conveyor Scanner:

- Fixed Focal Length Imaging Lens
- Variable Focal Distance Control

Side Conveyor Scanner:

- Fixed Focal Length Imaging Lens
- Dynamic Focal Distance Control

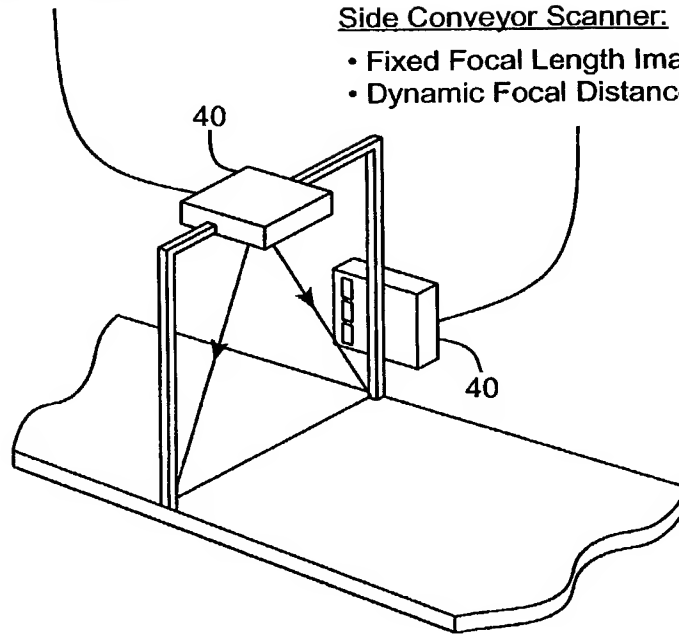


FIG. 2G

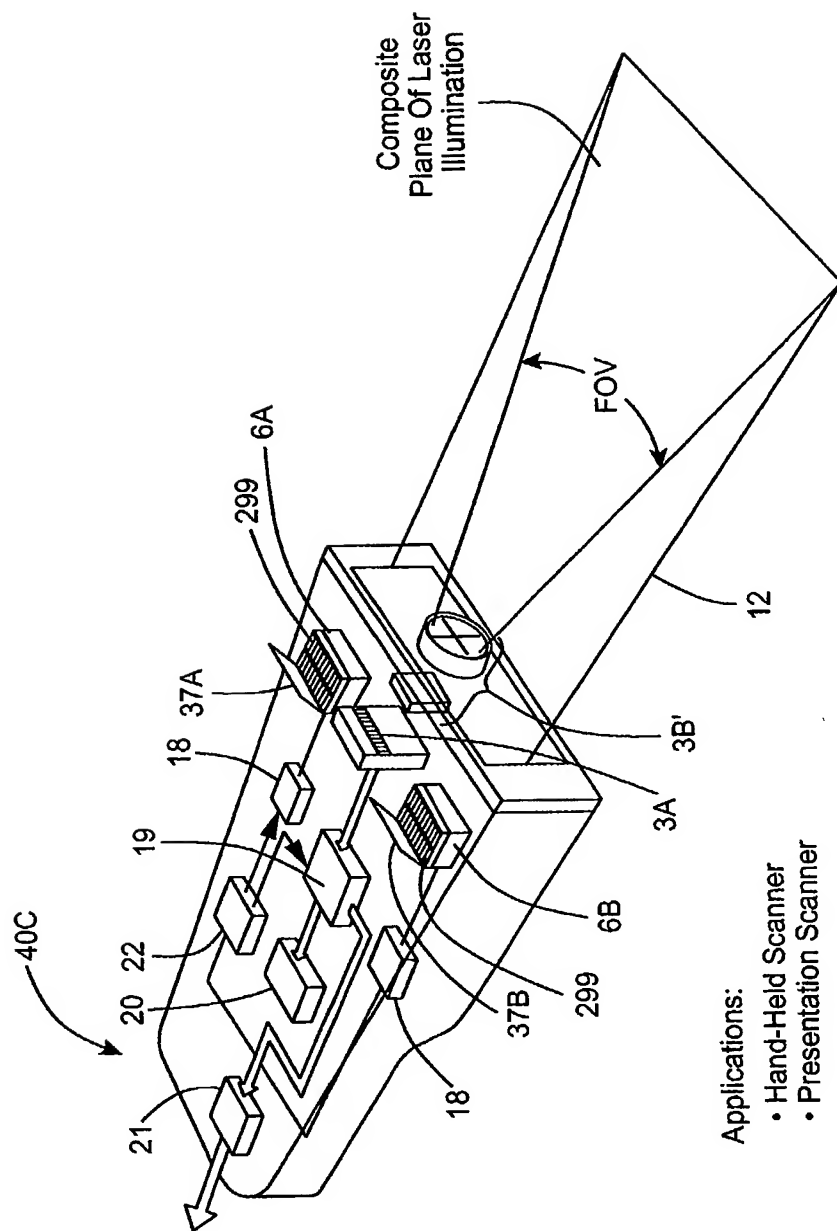


FIG. 2H

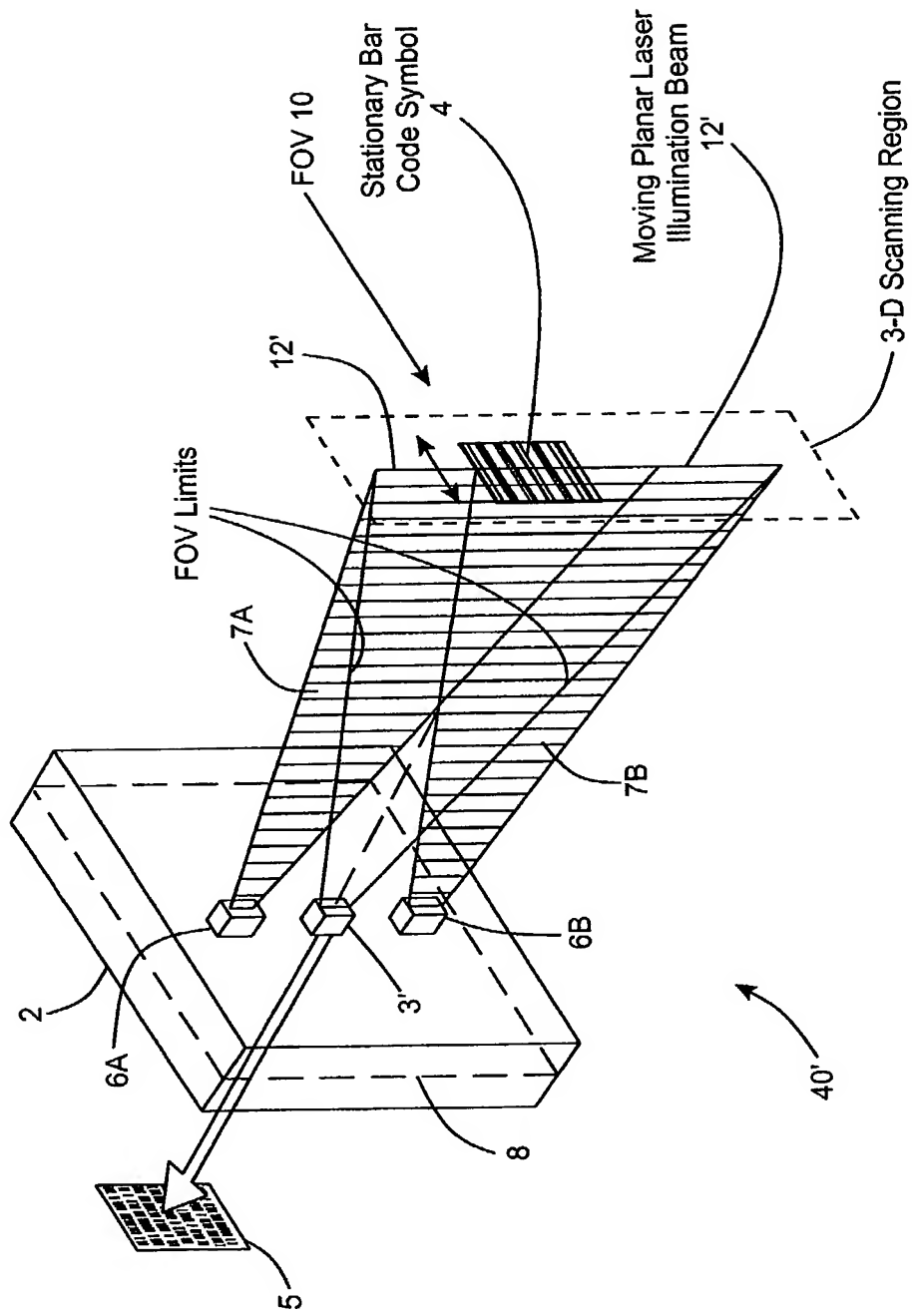


FIG. 211

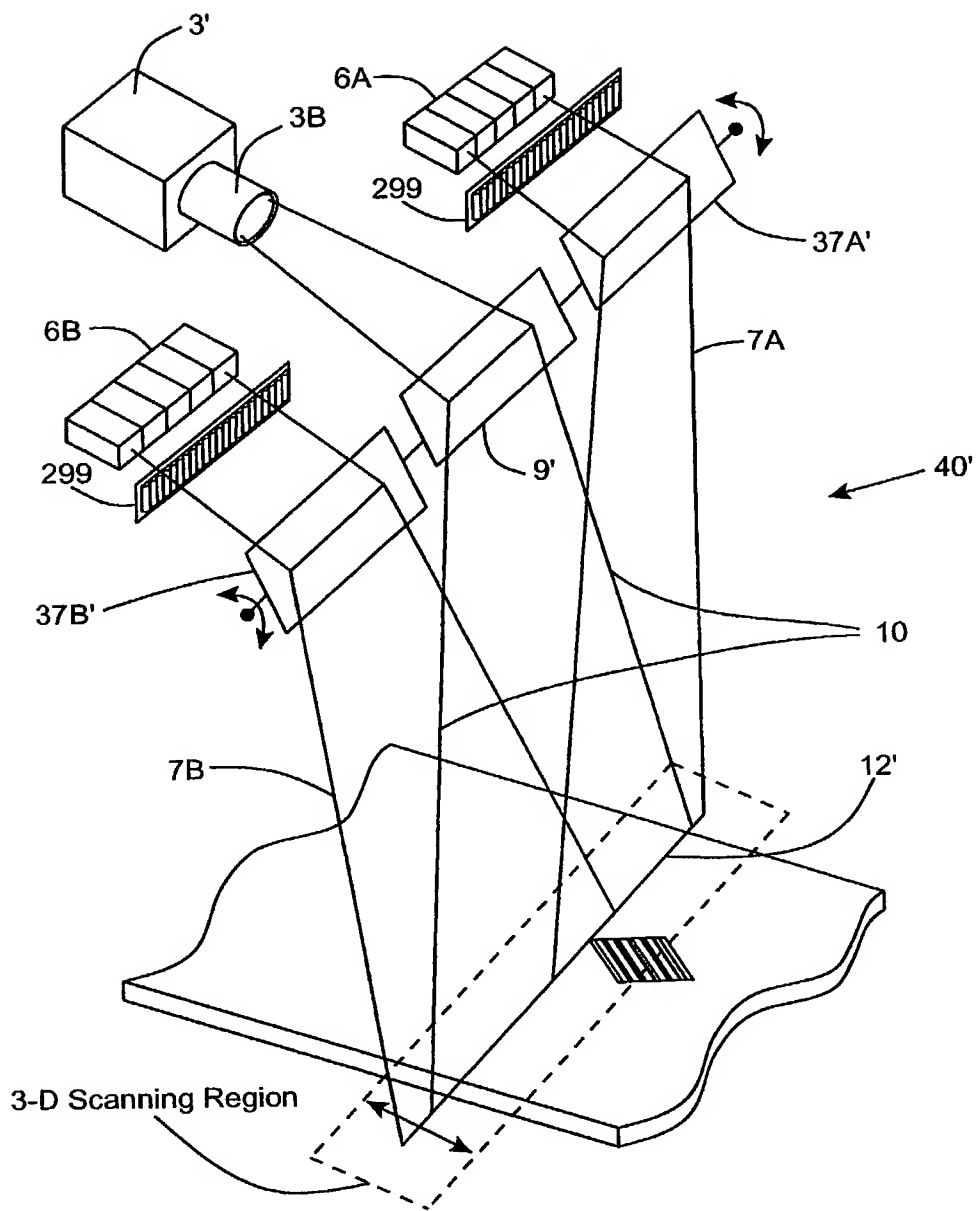


FIG. 212

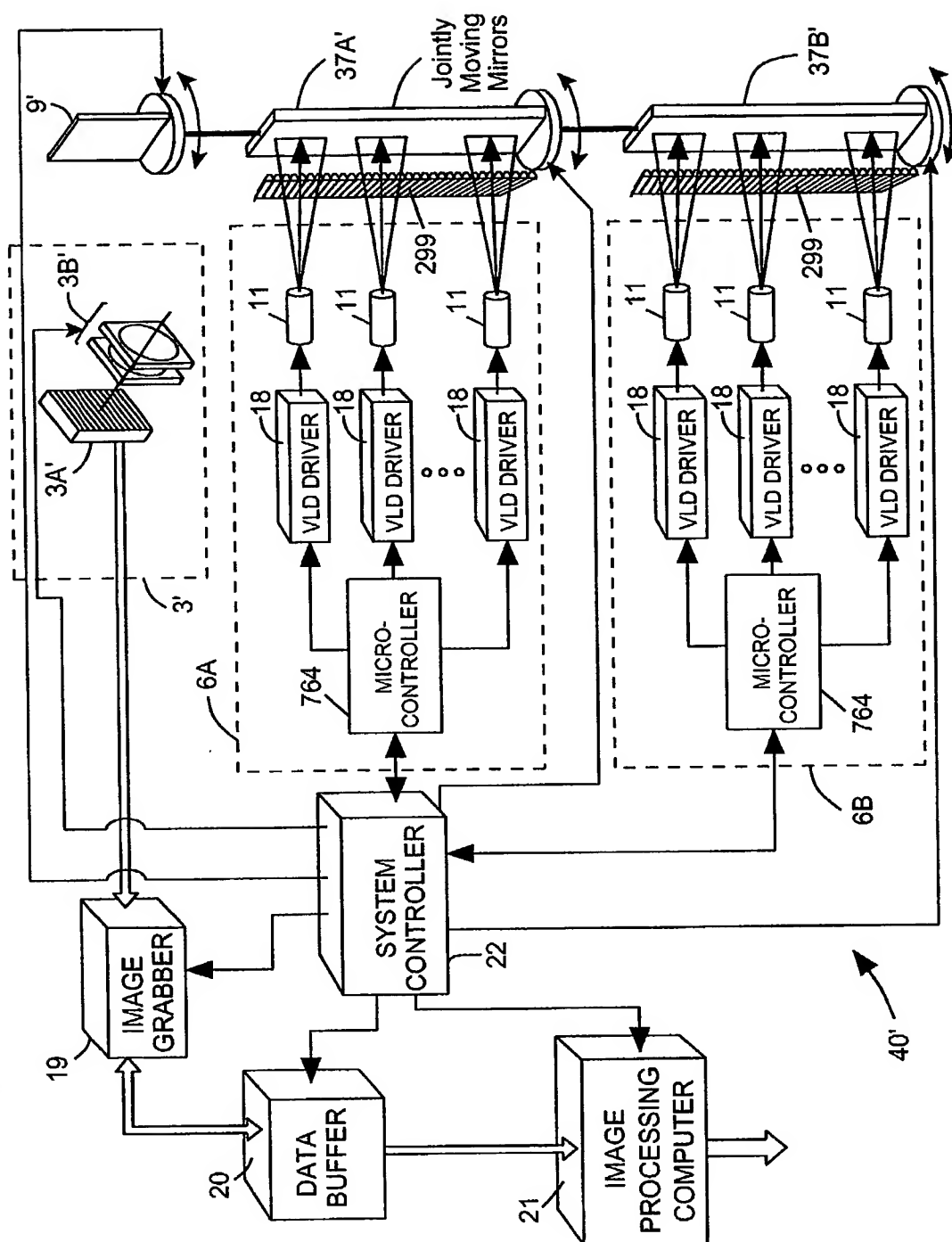


FIG. 213



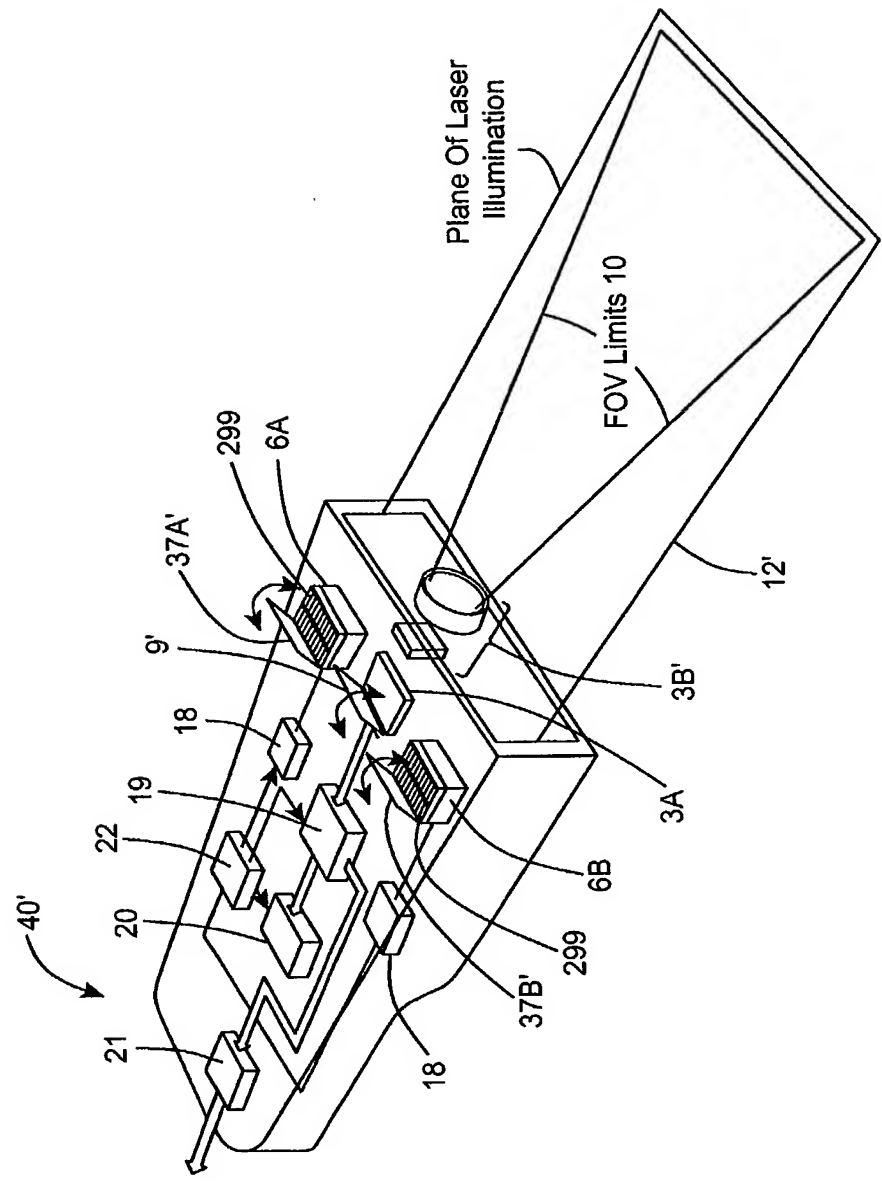


FIG. 215



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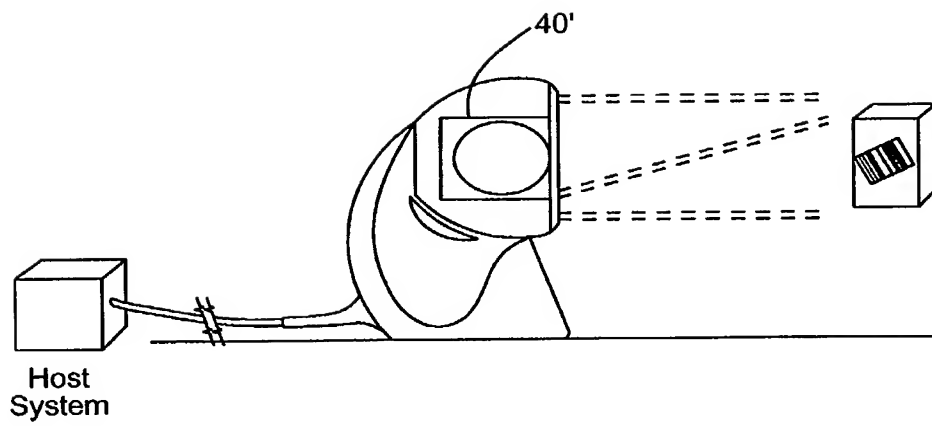


FIG. 216



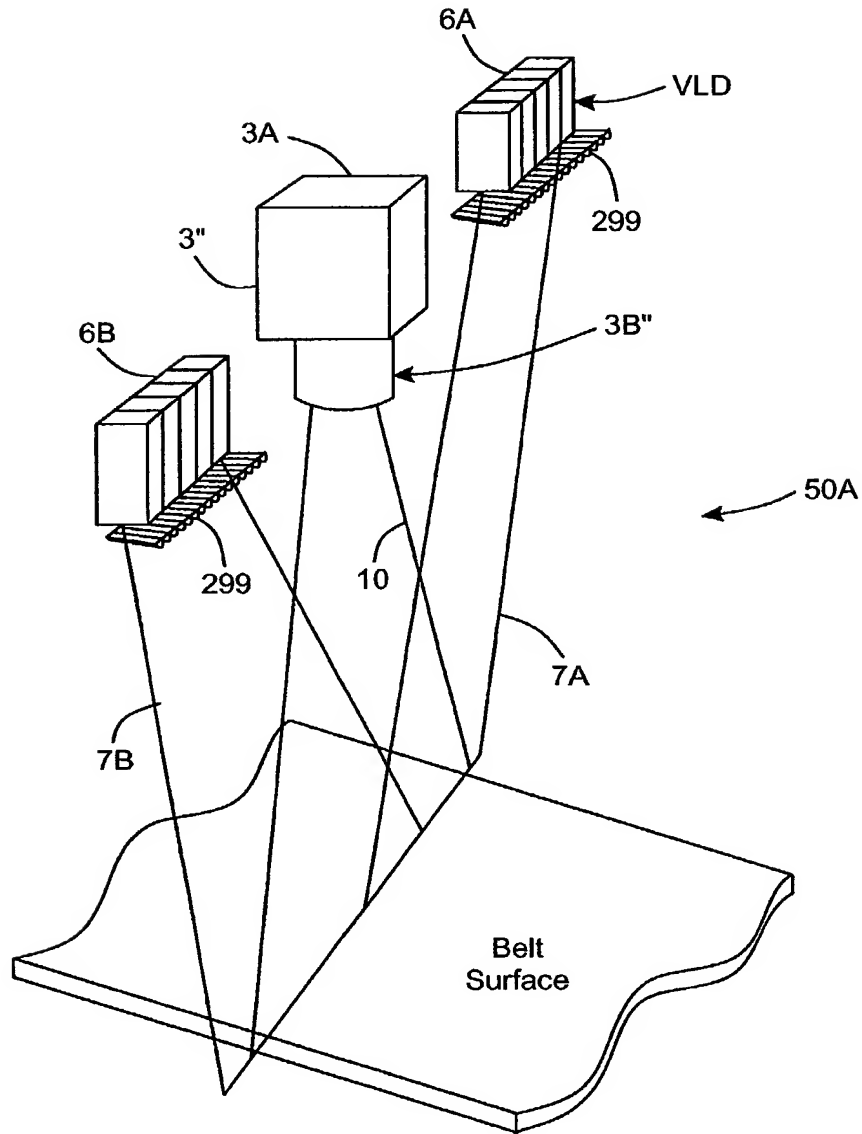


FIG. 3B1

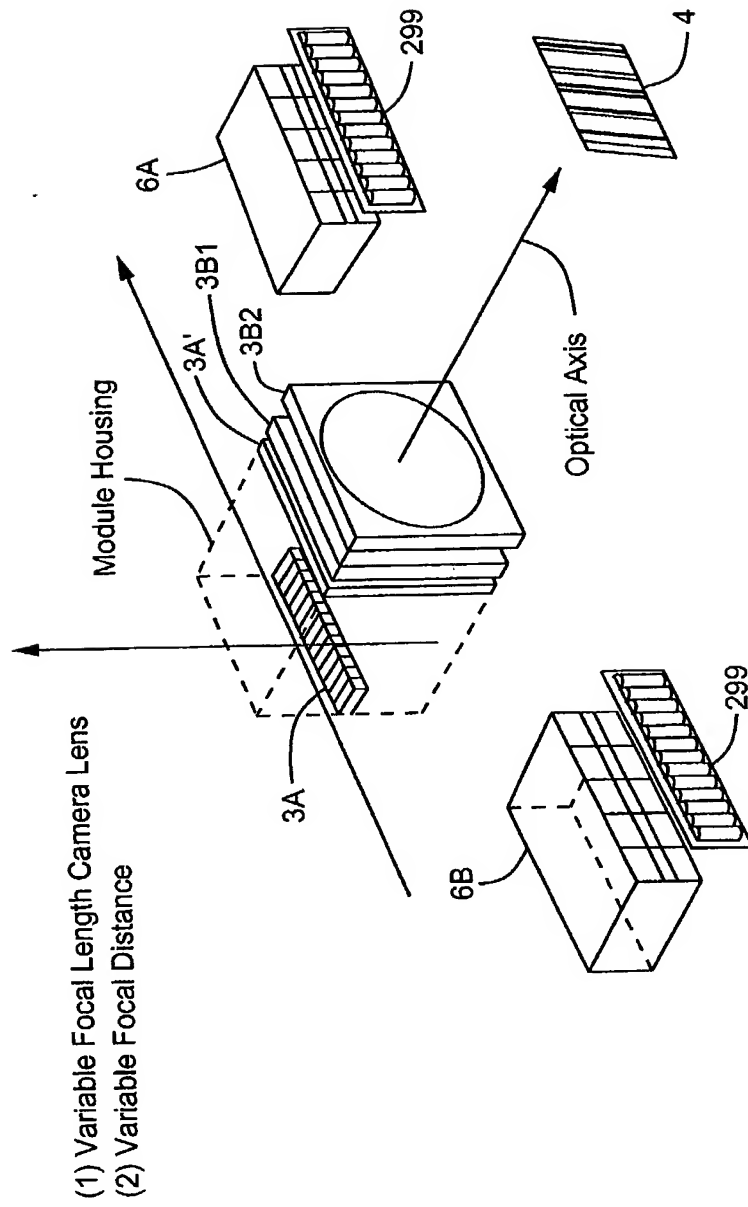


FIG. 3B2

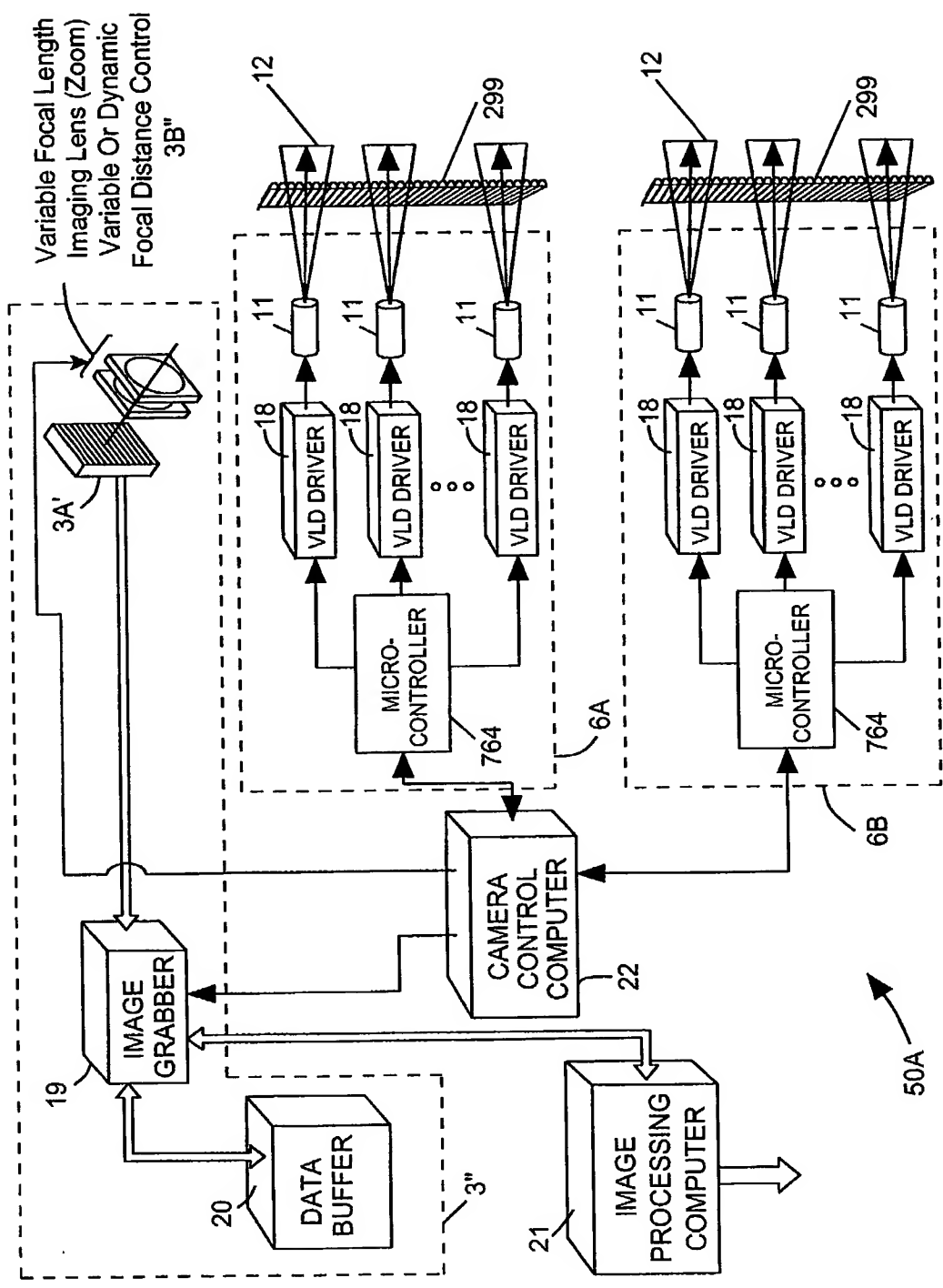
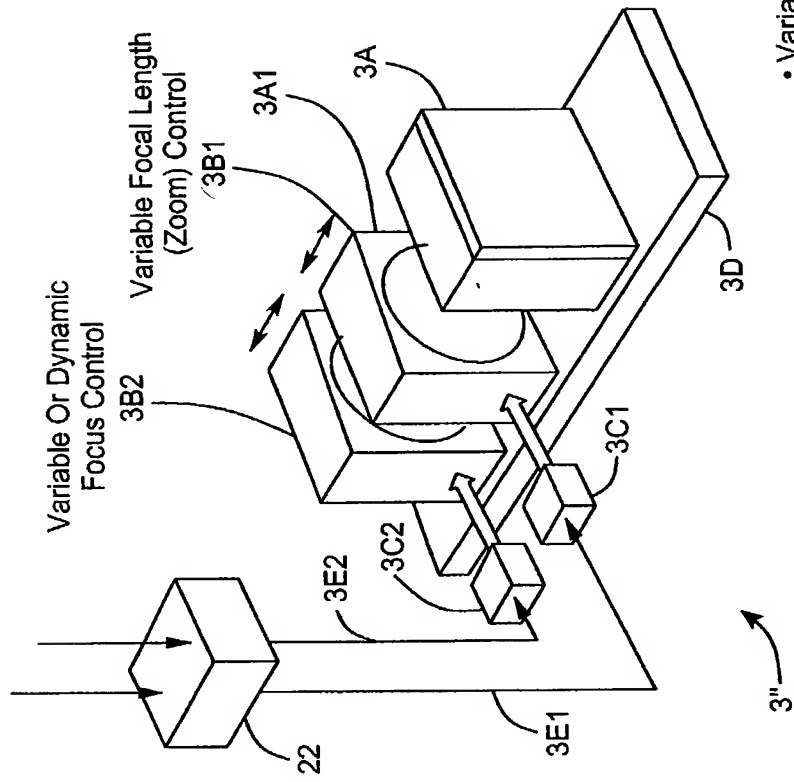


FIG. 3C1



- Variable Focal Length Camera Lens
- Variable Focal Distance

FIG. 3C2

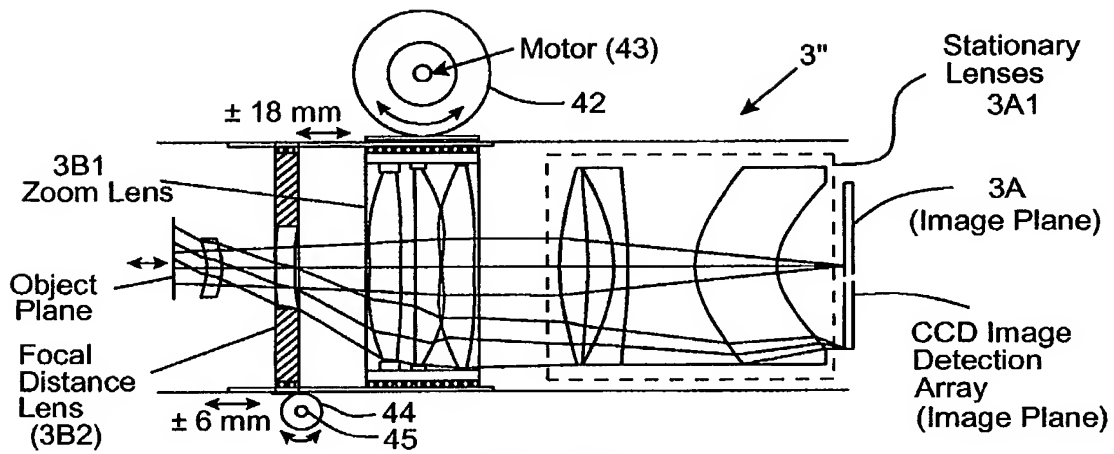


FIG. 3D1

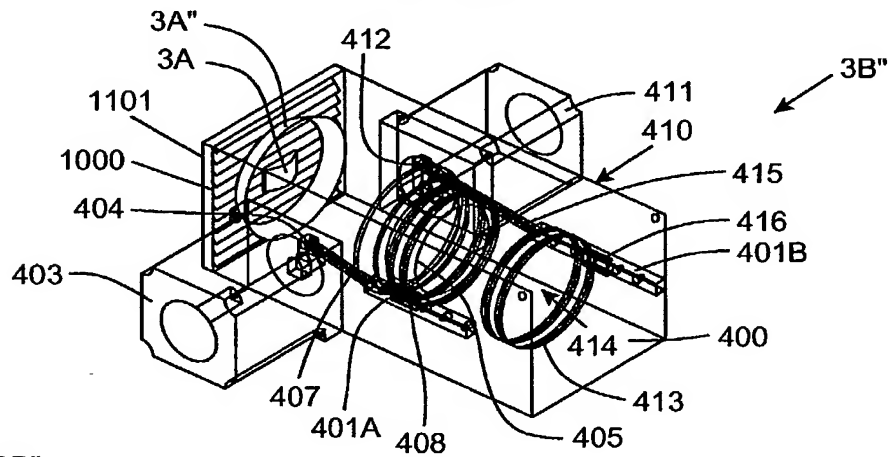


FIG. 3D2

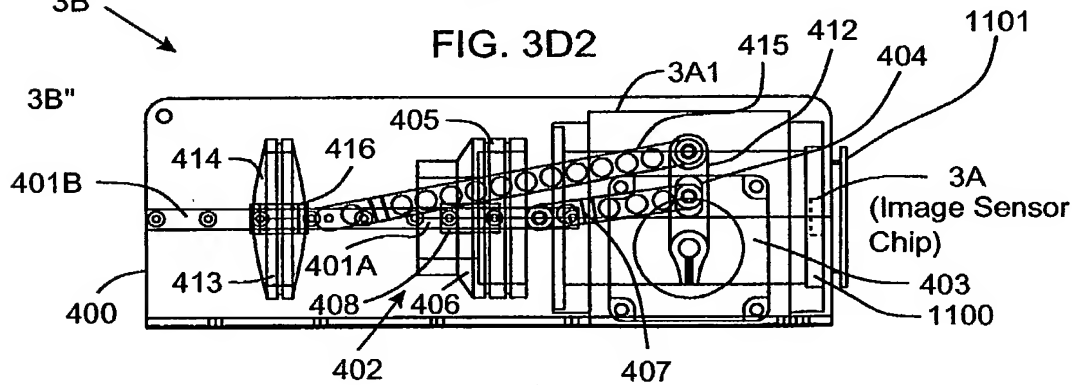


FIG. 3D3

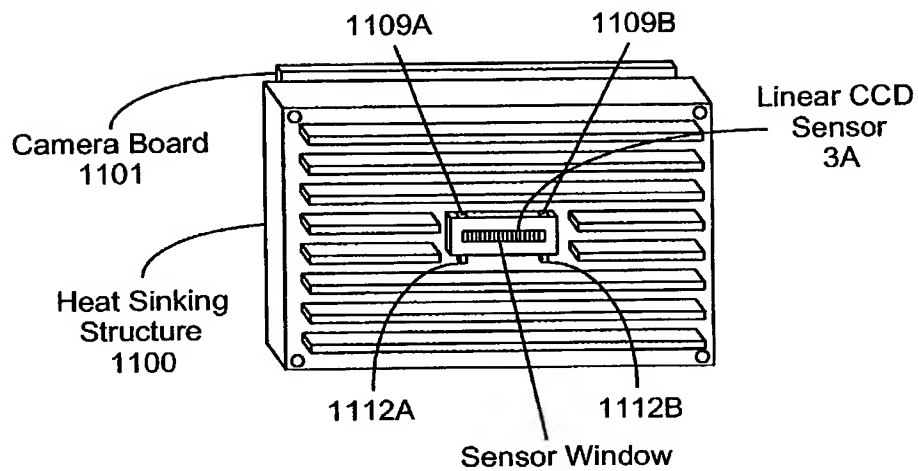


FIG. 3D4

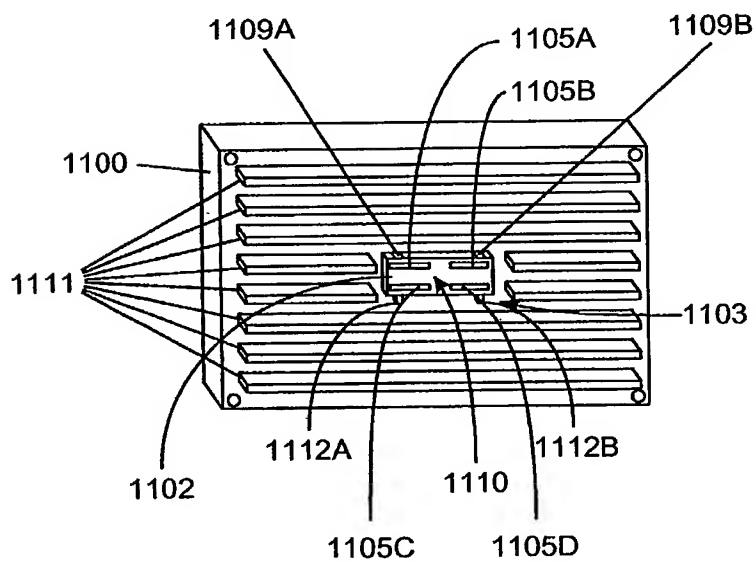


FIG. 3D5



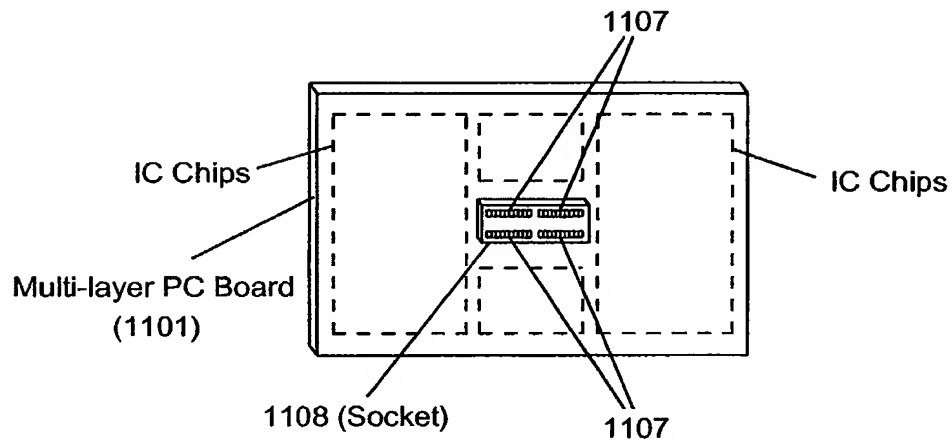


FIG. 3D6

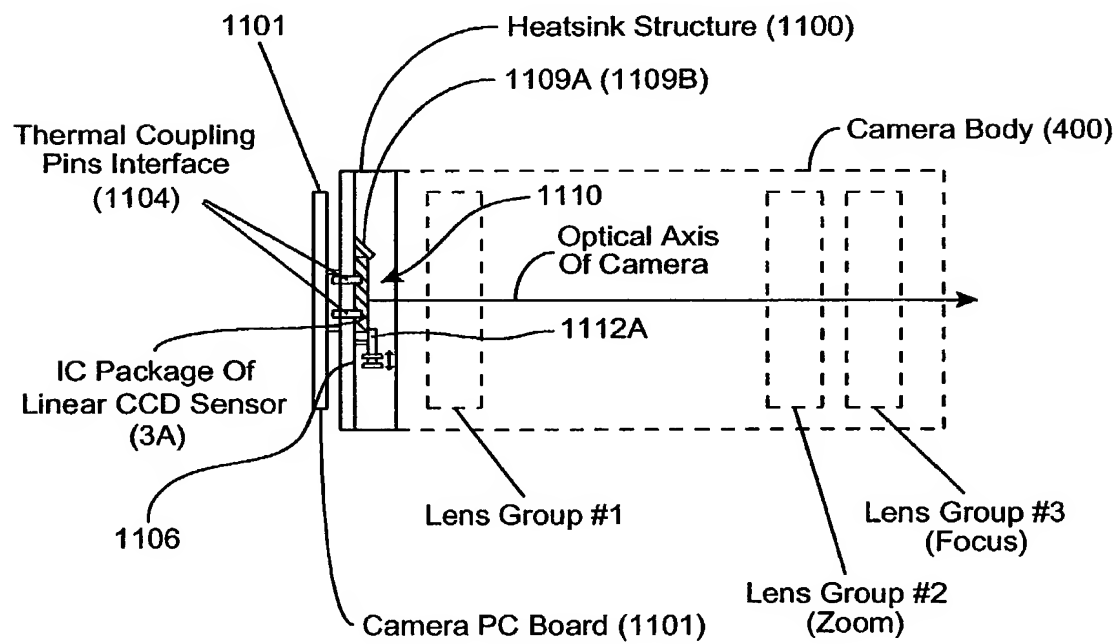


FIG. 3D7

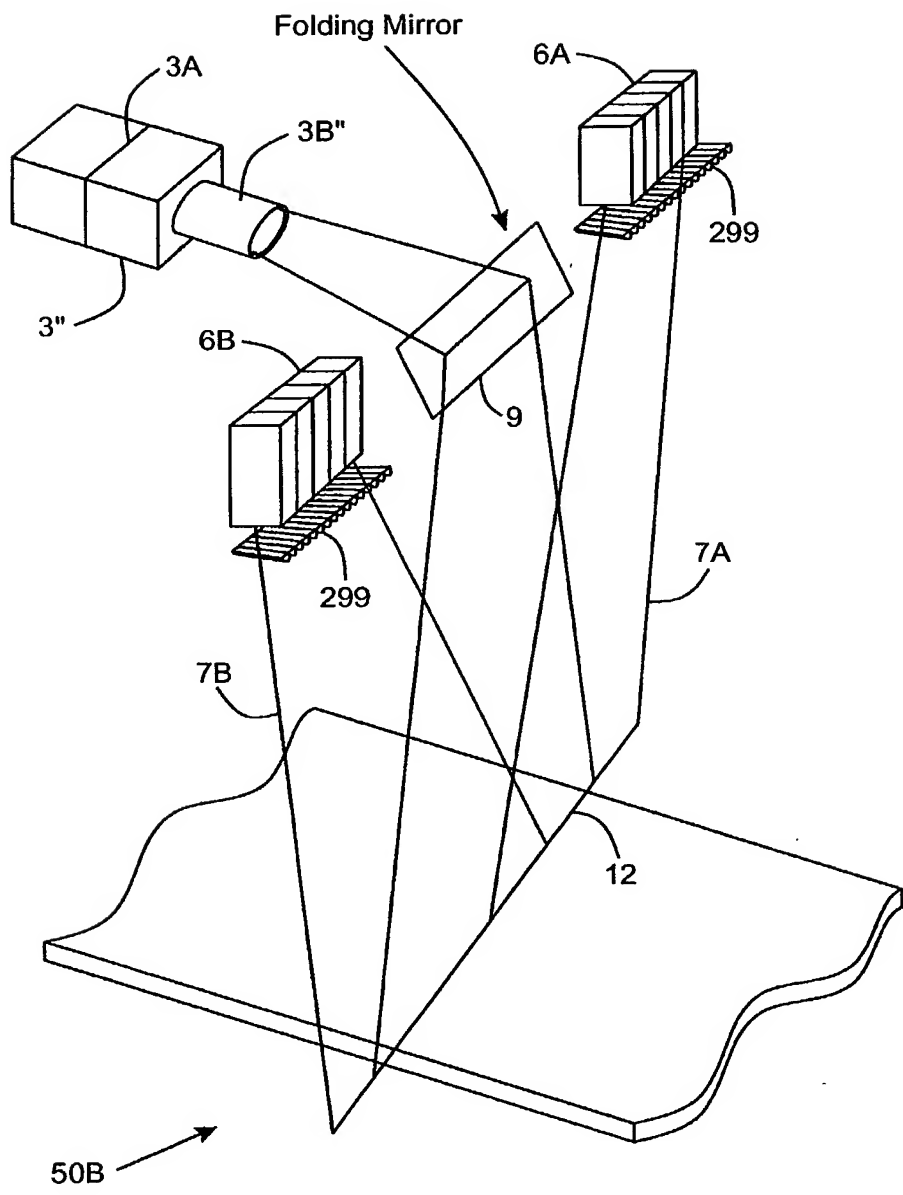


FIG. 3E1

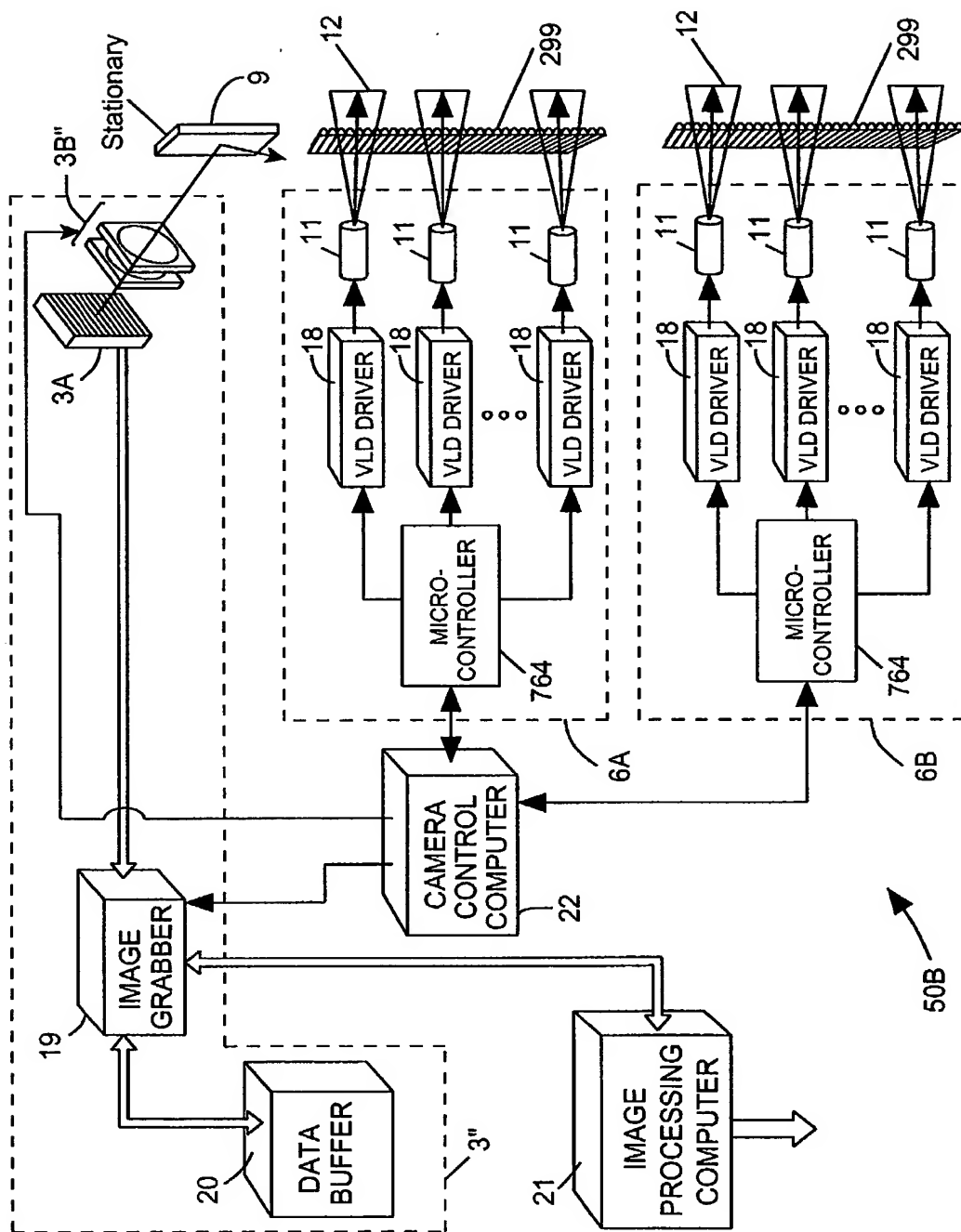


FIG. 3E2

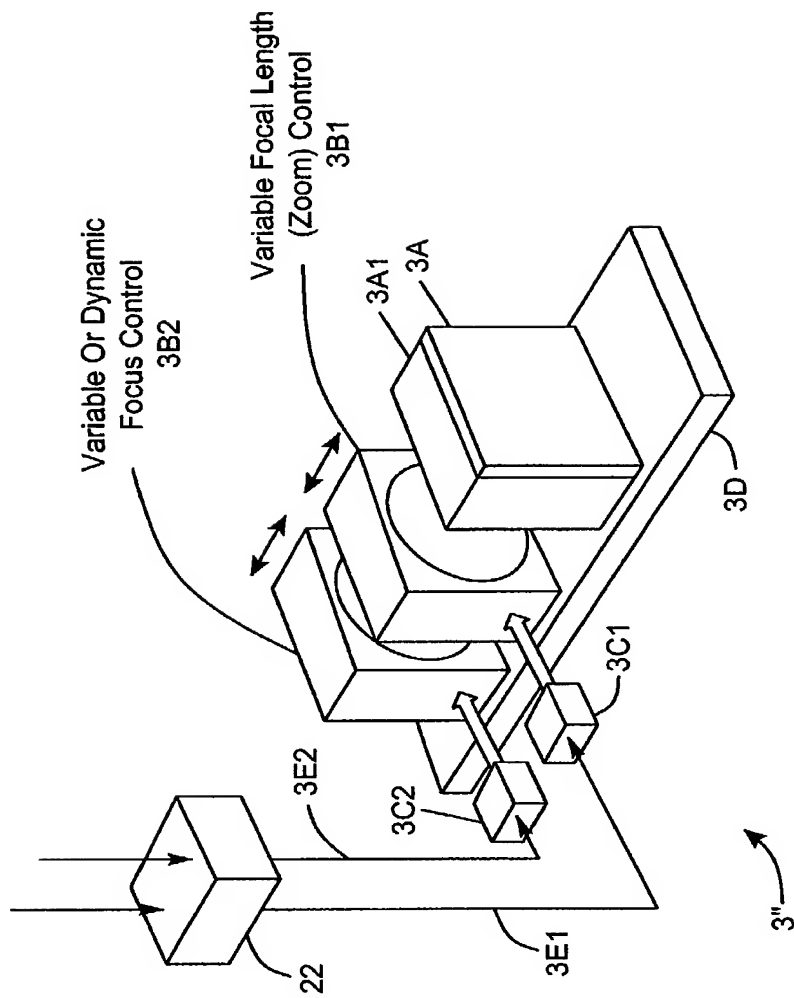


FIG. 3E3



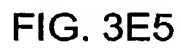


FIG. 3E5

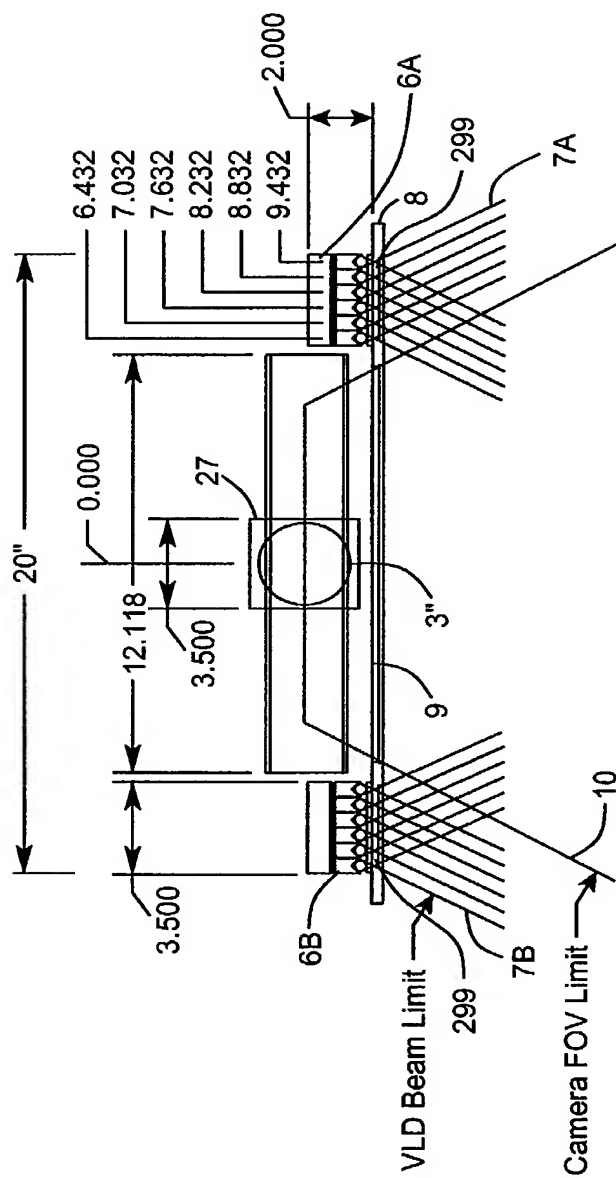


FIG. 3E6

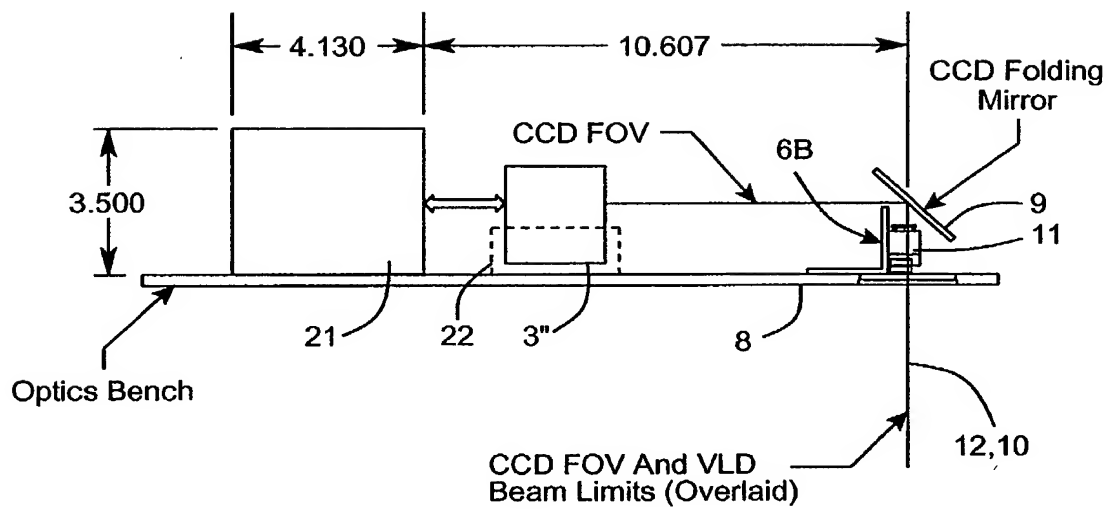


FIG. 3E7



\* Variable FOV

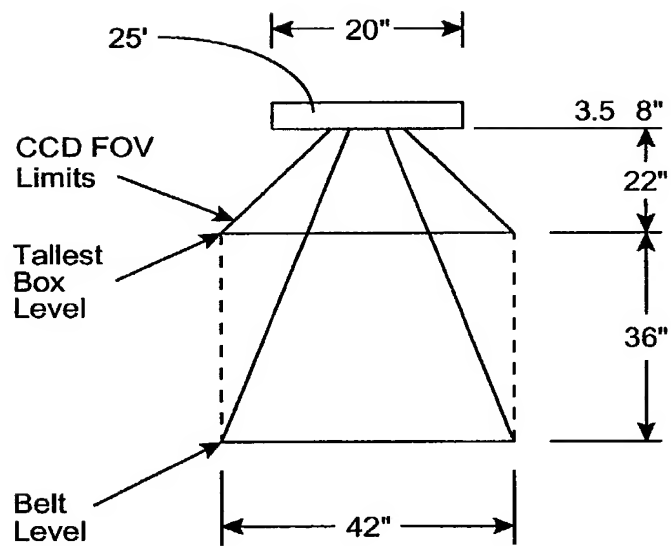


FIG. 3E8

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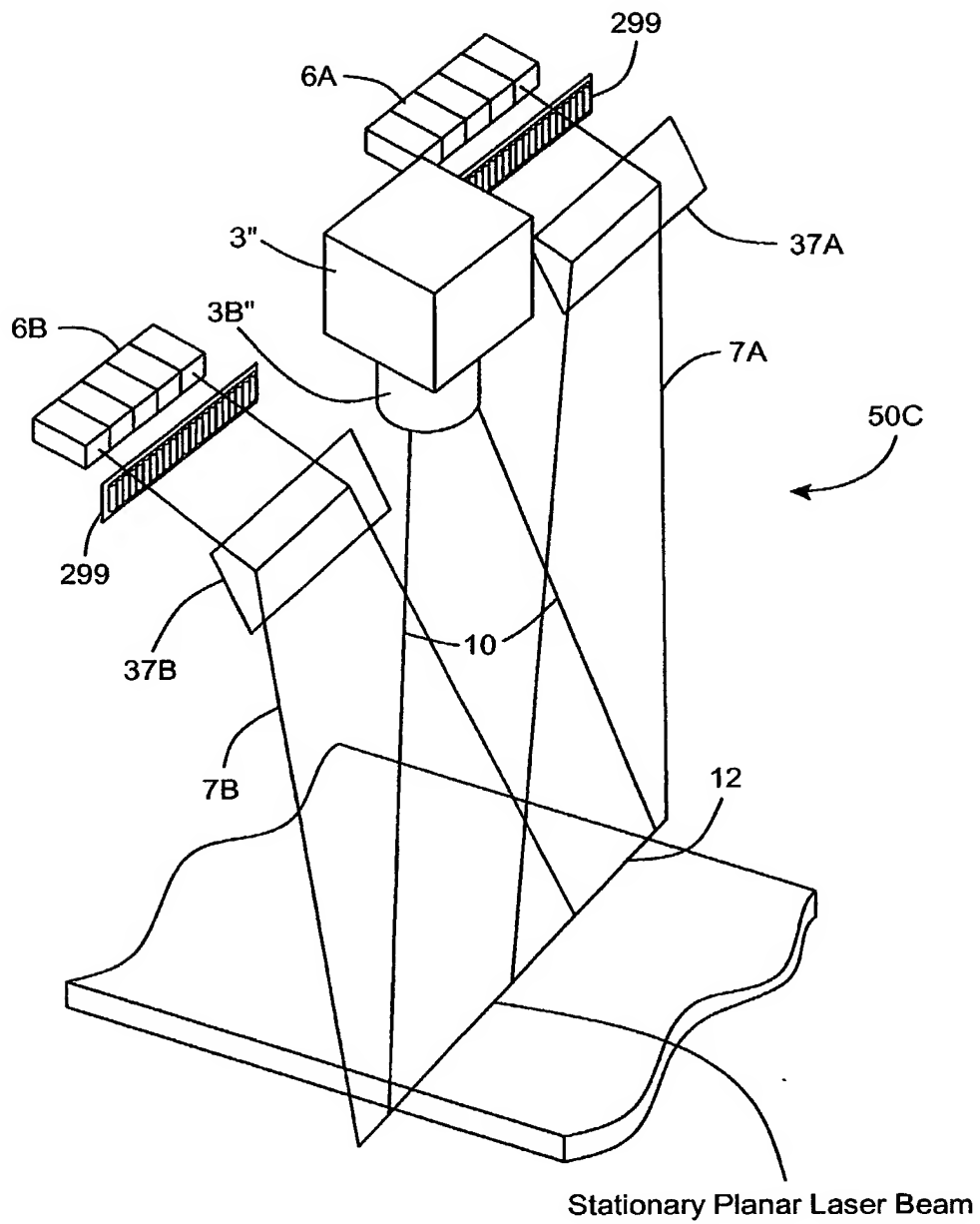


FIG. 3F1



**FIG. 3F2**

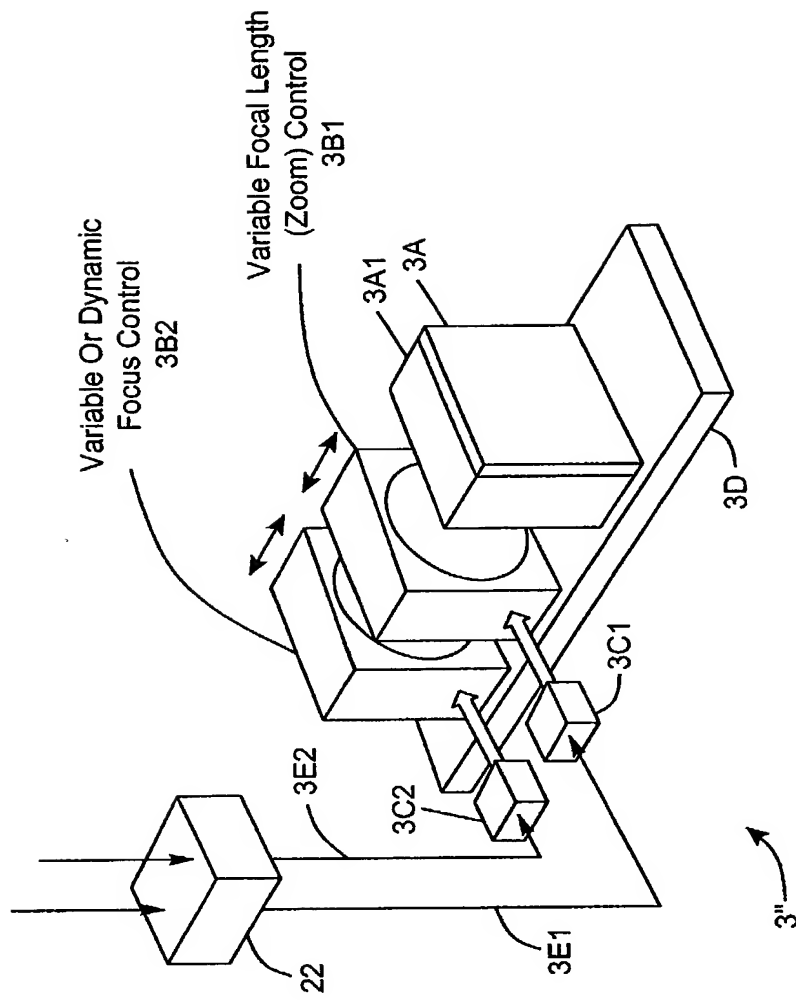


FIG. 3F3

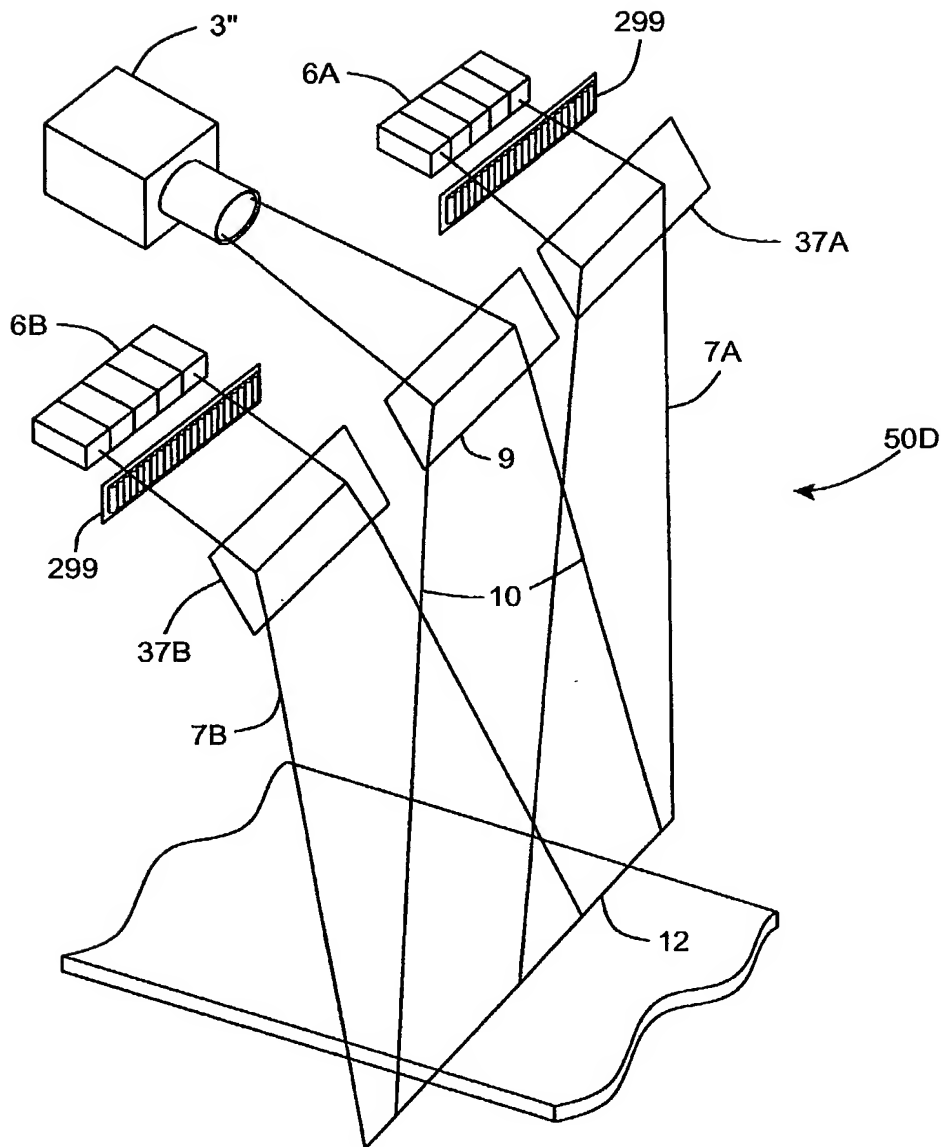


FIG. 3G1

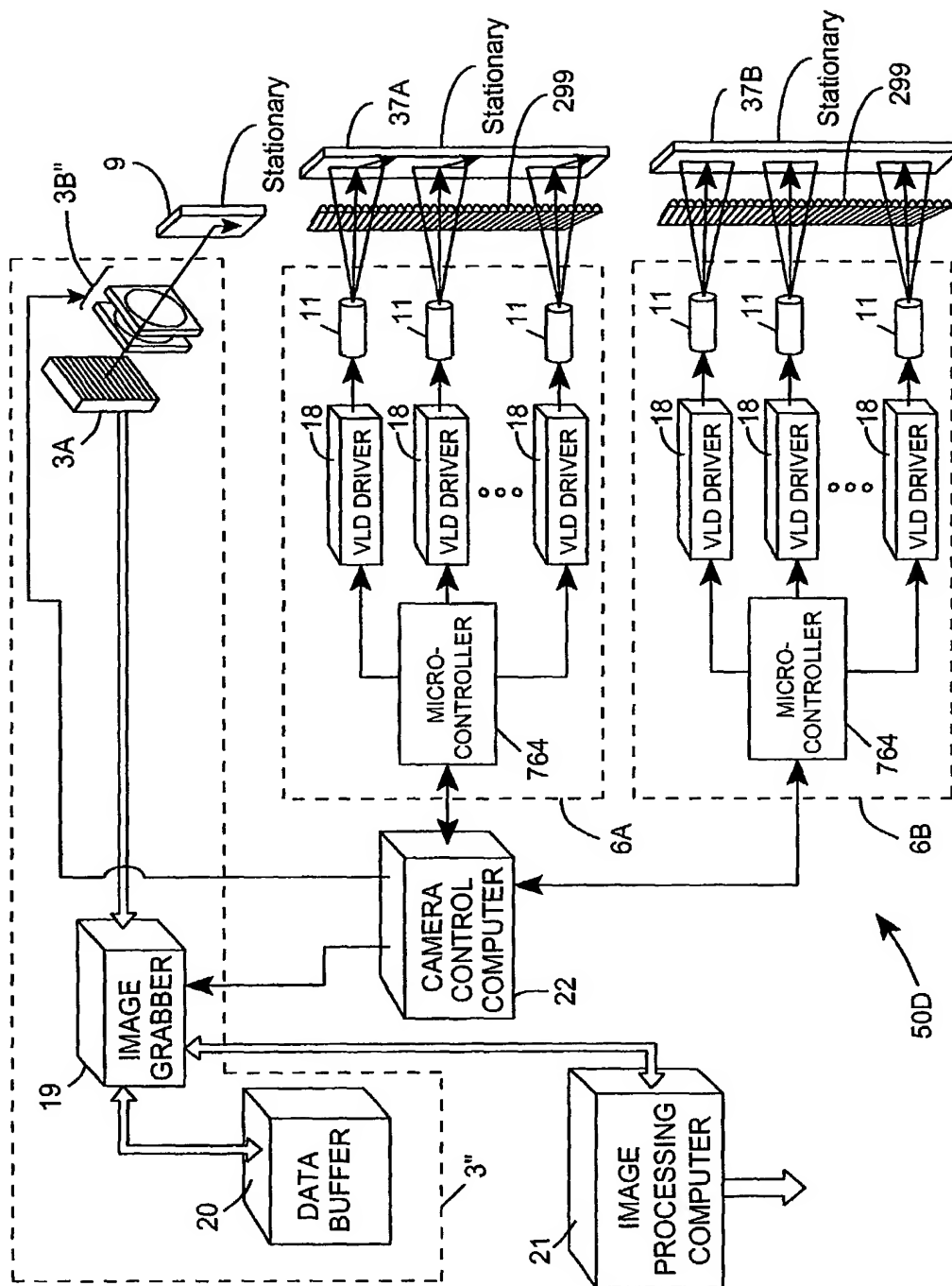


FIG. 3G2

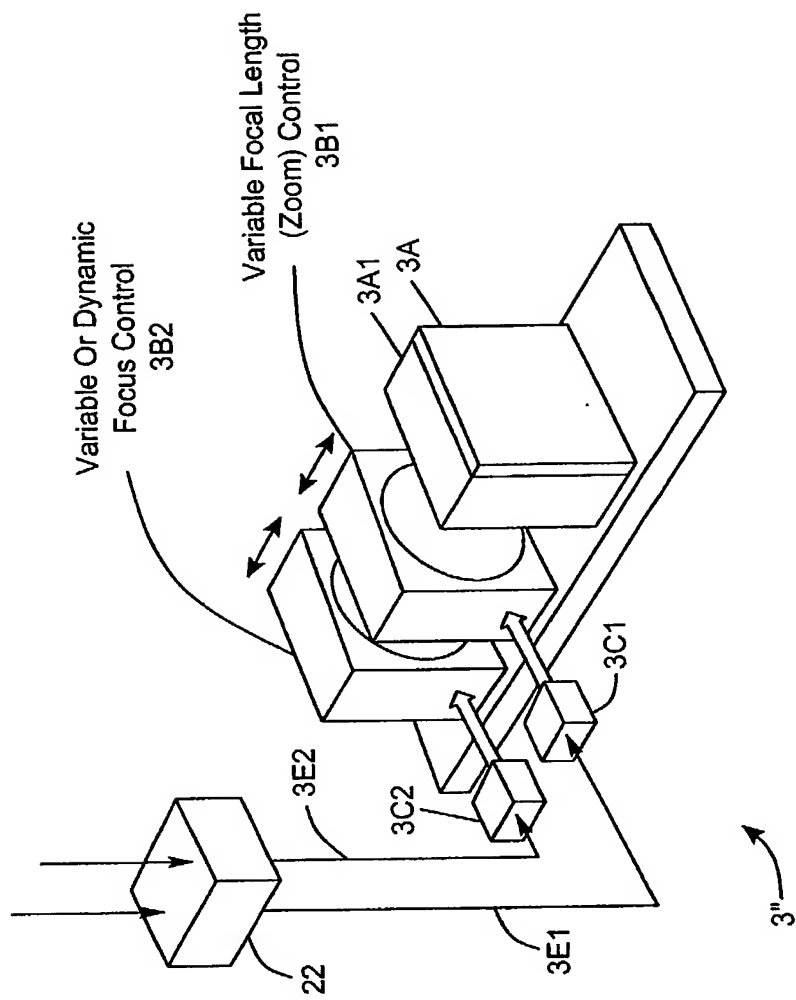


FIG. 3G3

- Variable Focal Length Imaging Lens
- Variable Focal Distance

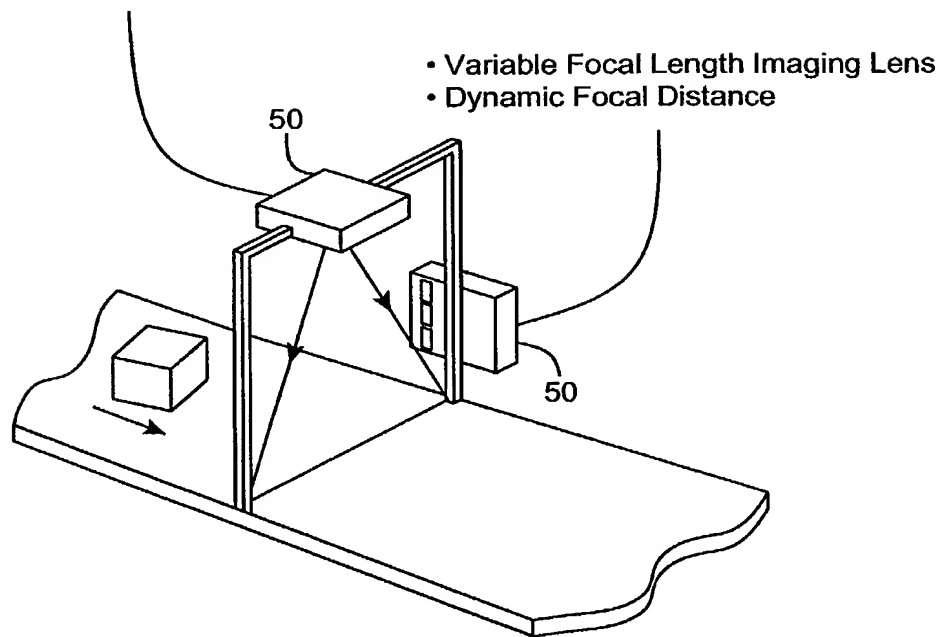


FIG. 3H



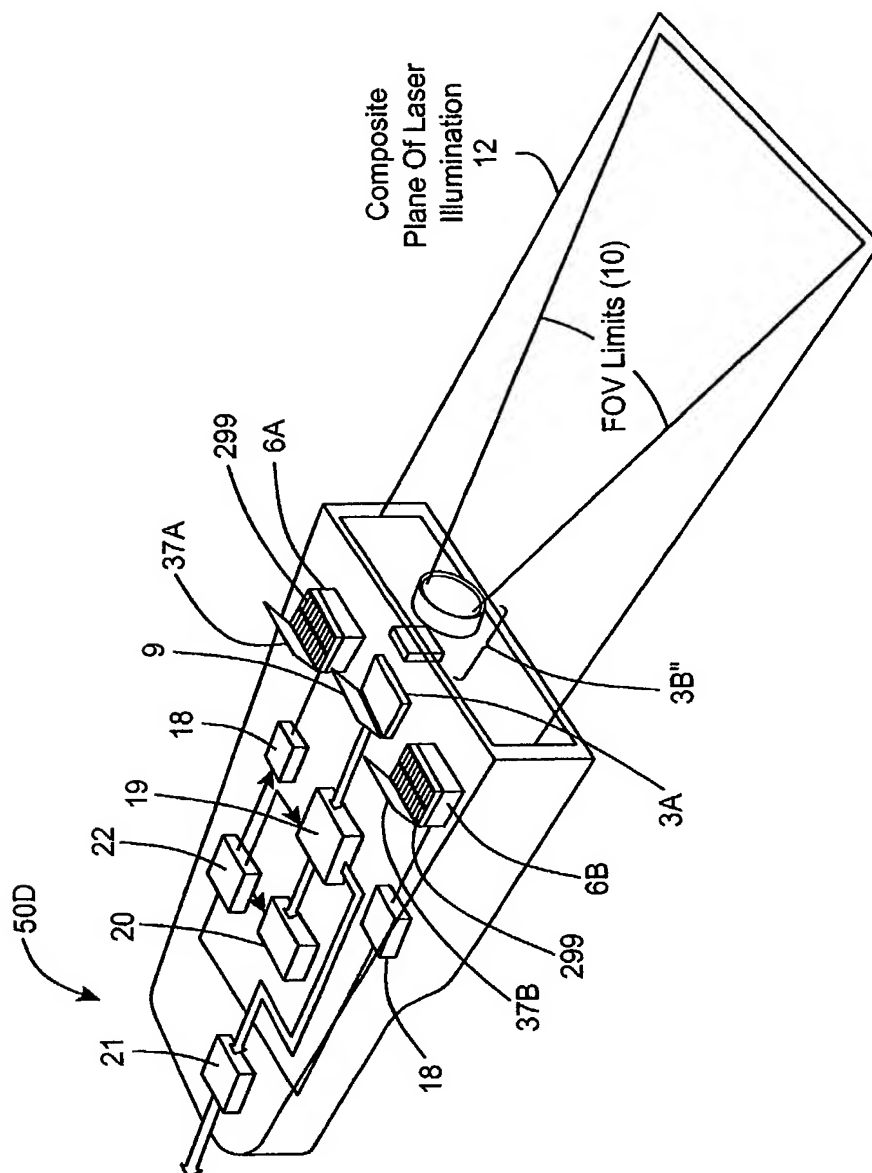


FIG. 31

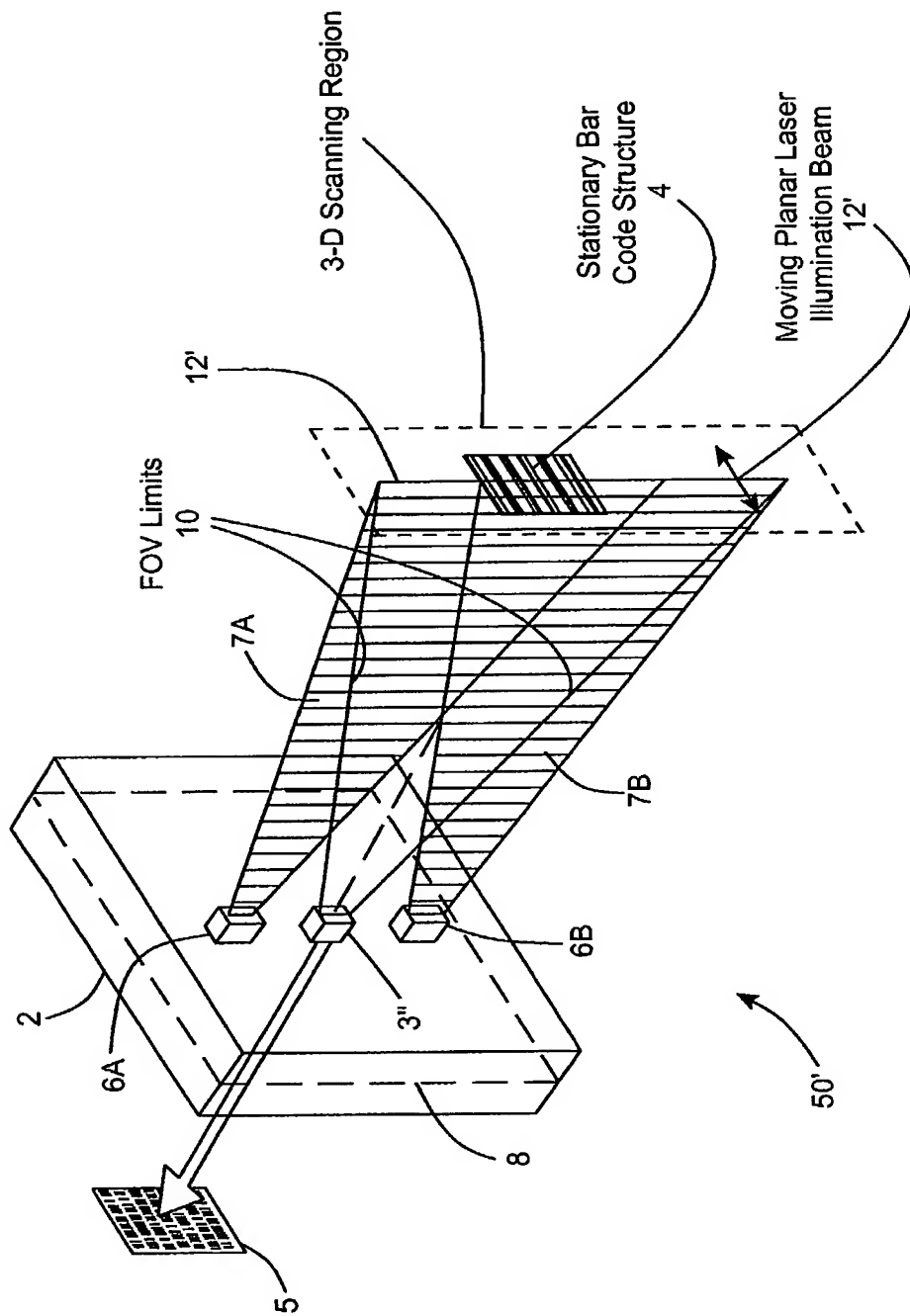


FIG. 3J1

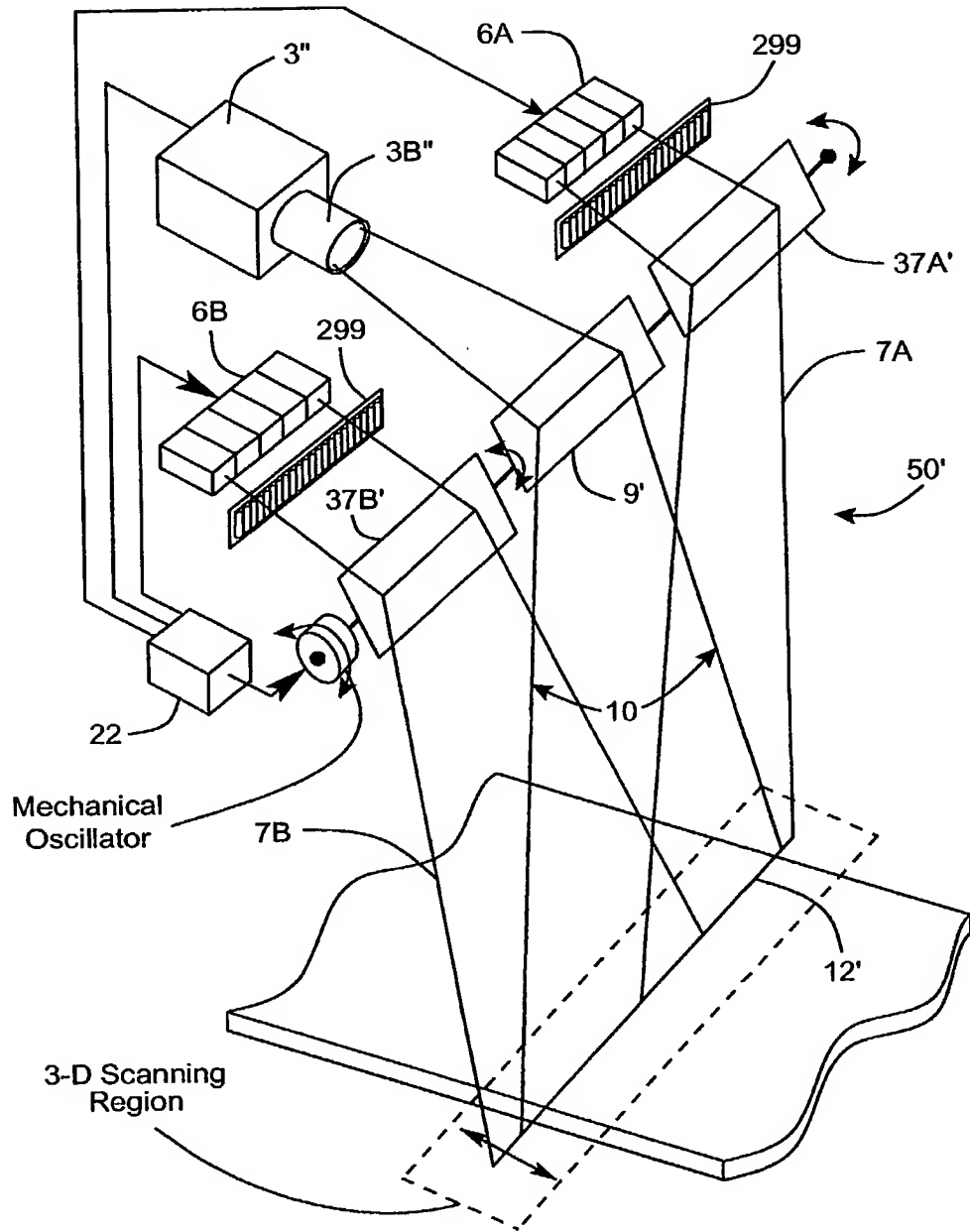


FIG. 3J2

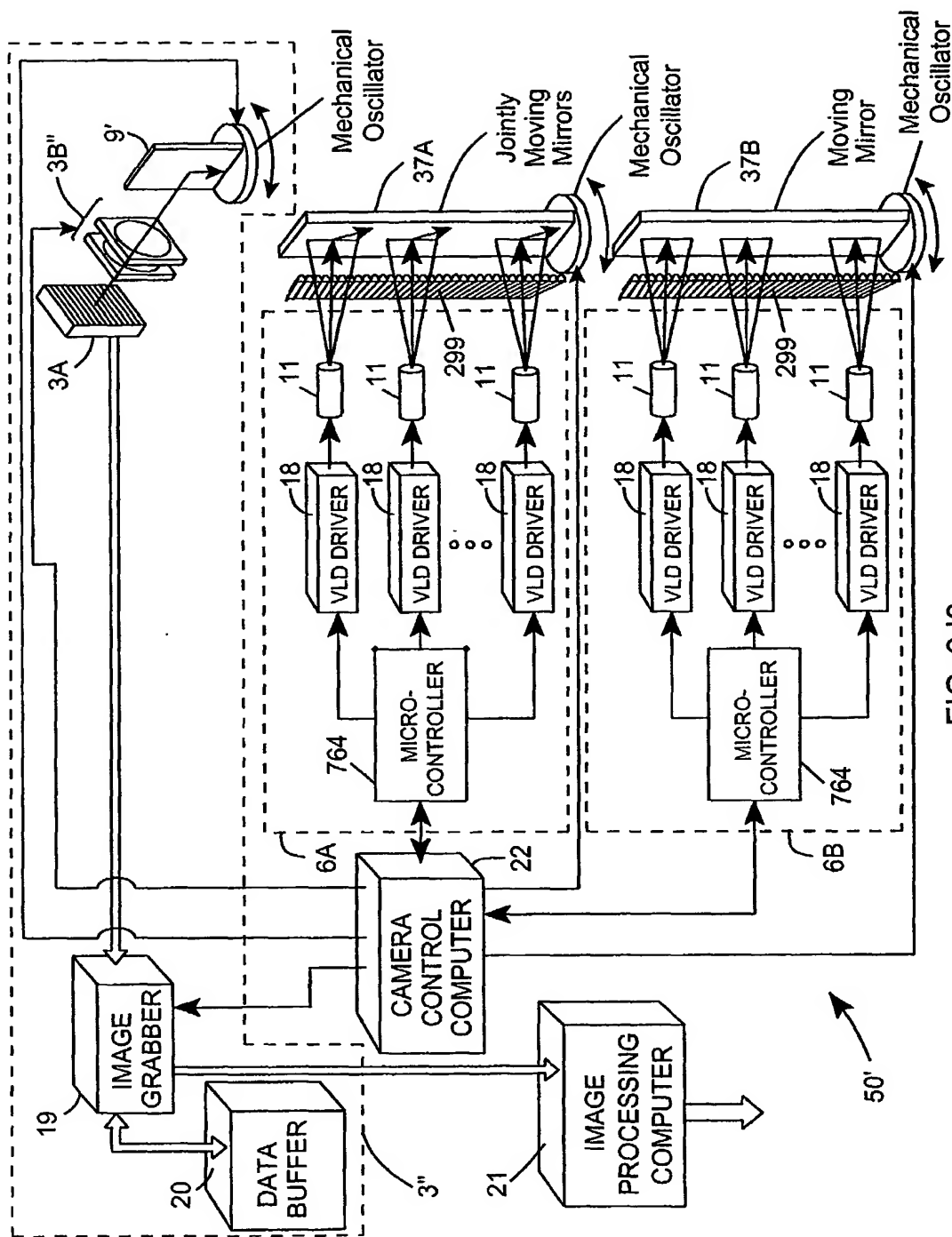
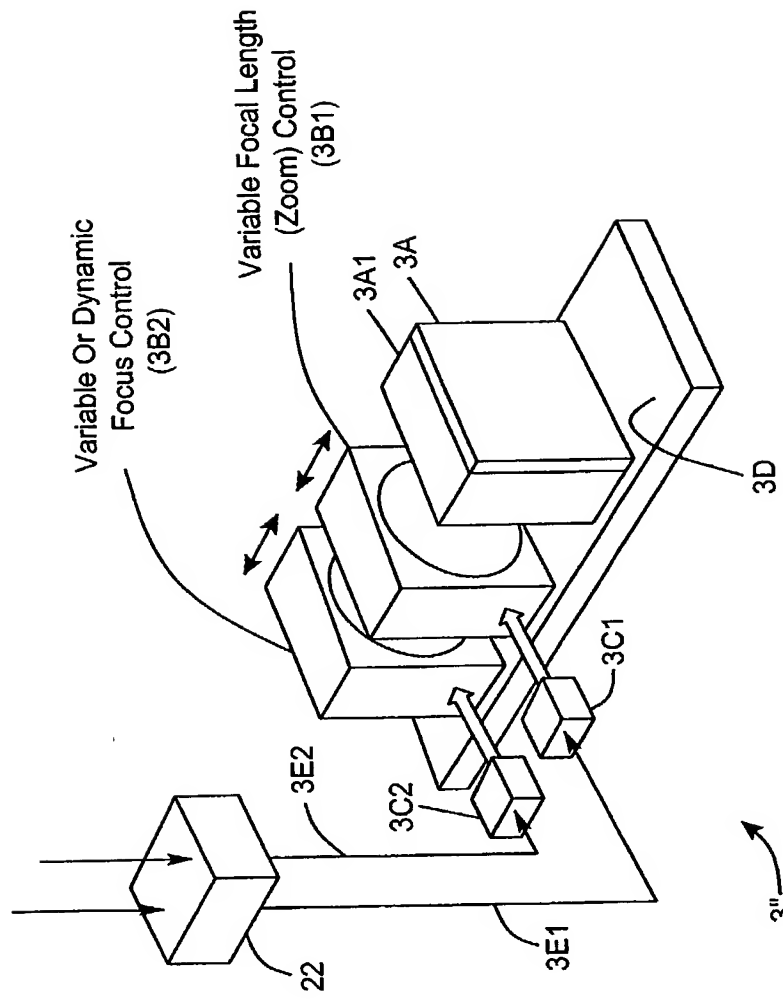


FIG. 3J3



**FIG. 3J4**

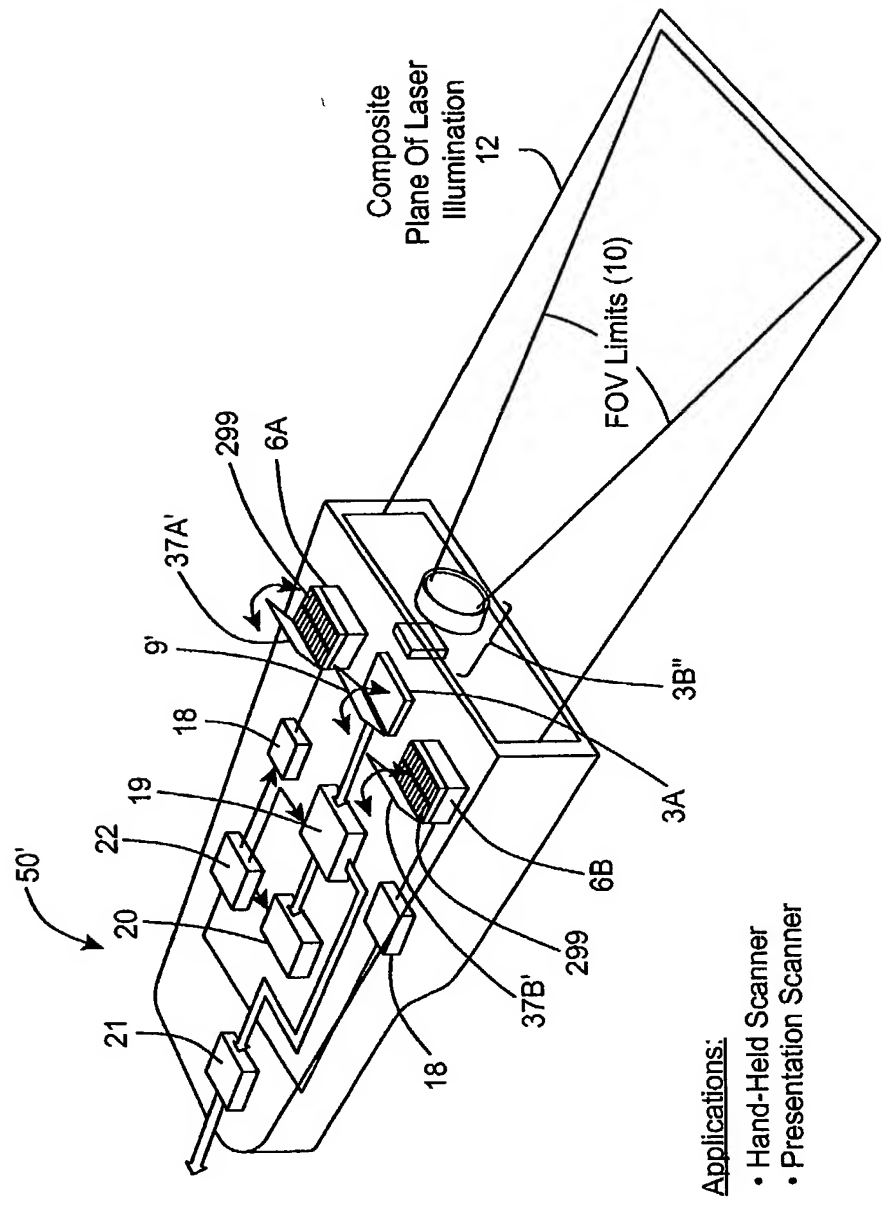
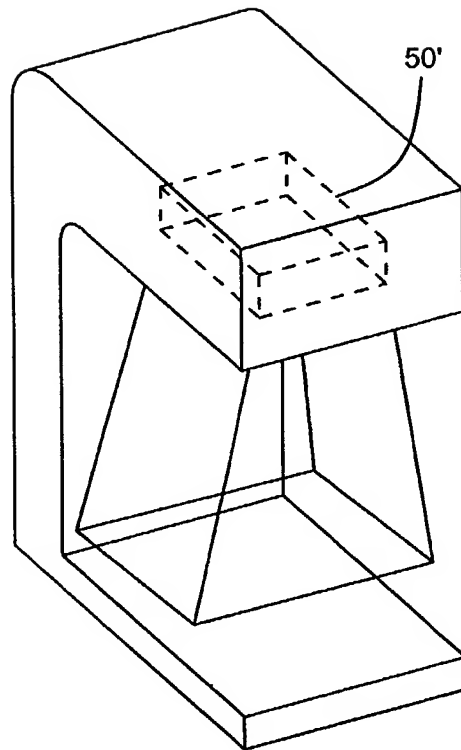


FIG. 3J5

- Applications:
- Hand-Held Scanner
  - Presentation Scanner



2-D Hold-under Scanner

FIG. 3J6

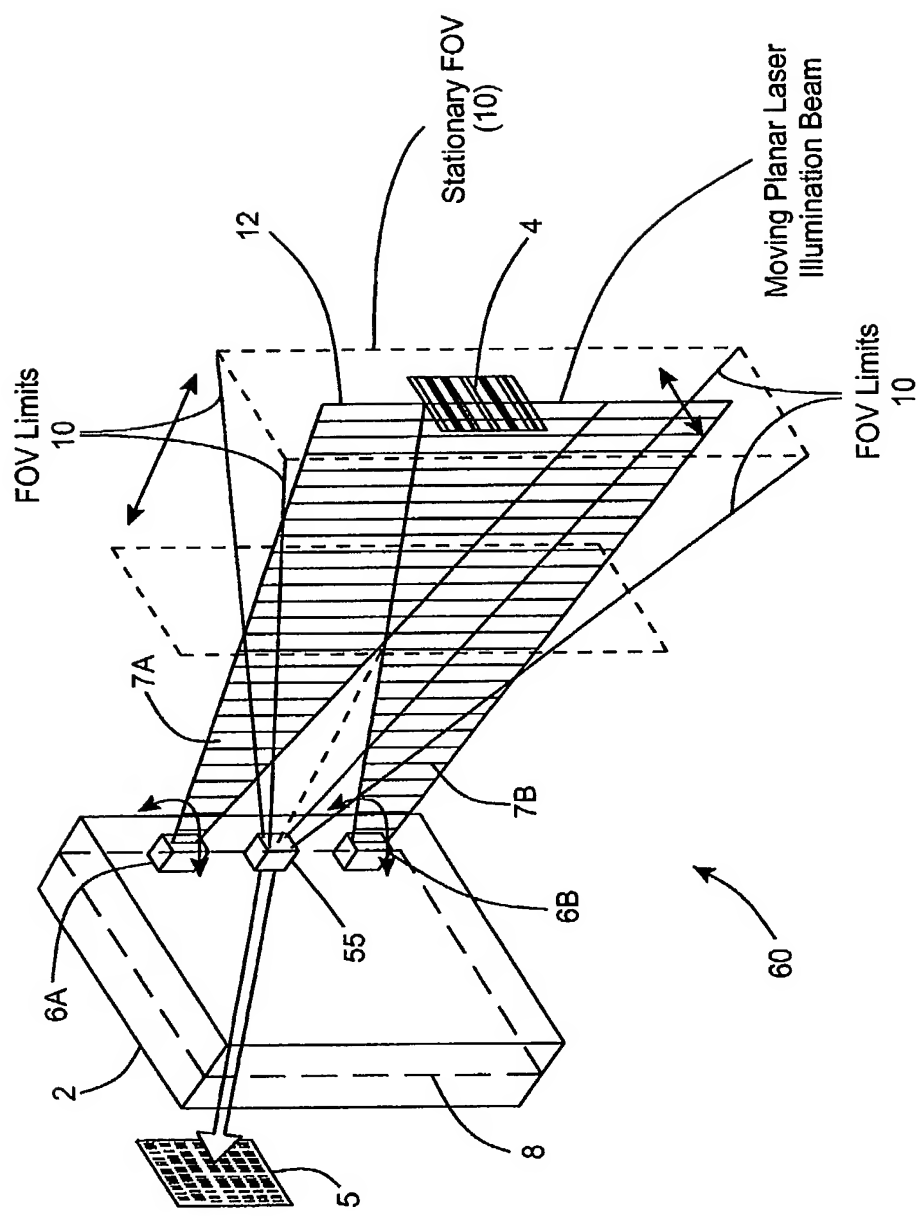


FIG. 4A



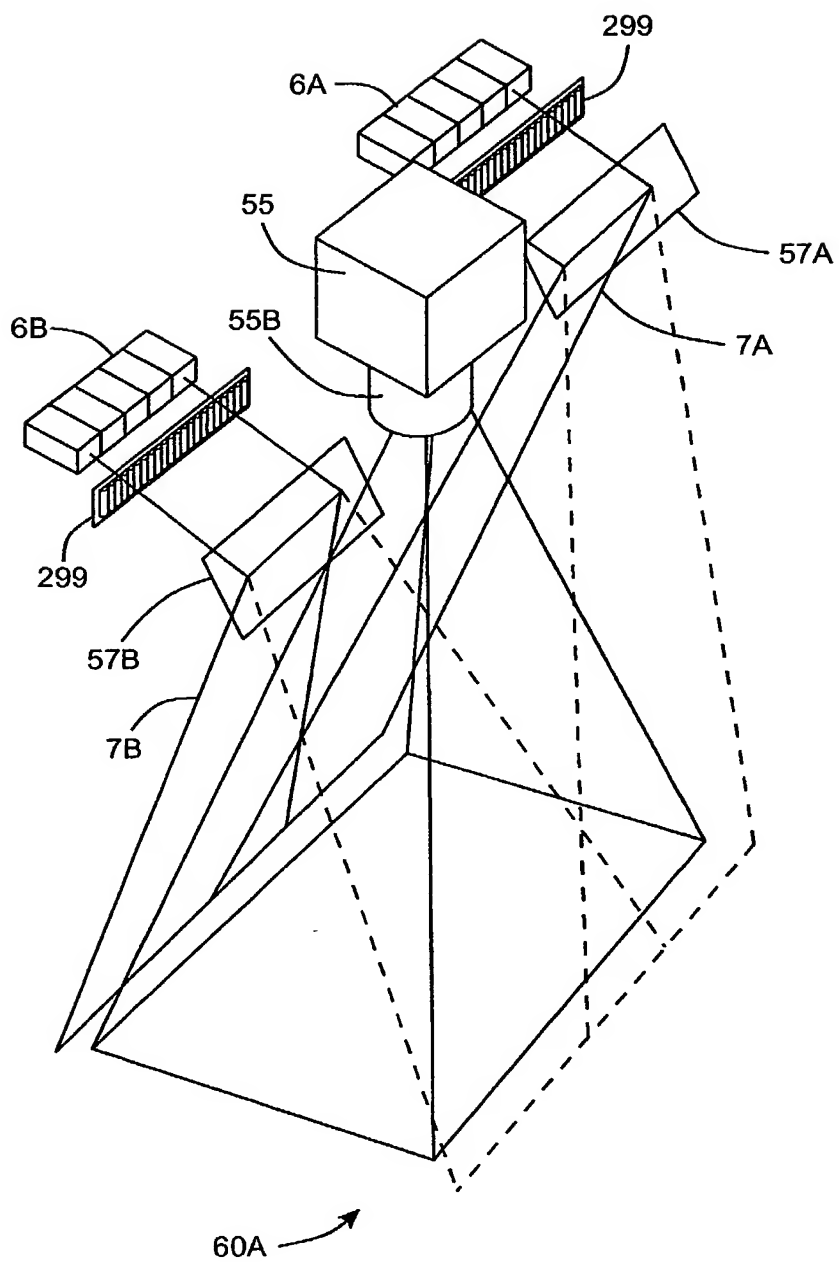


FIG. 4B1

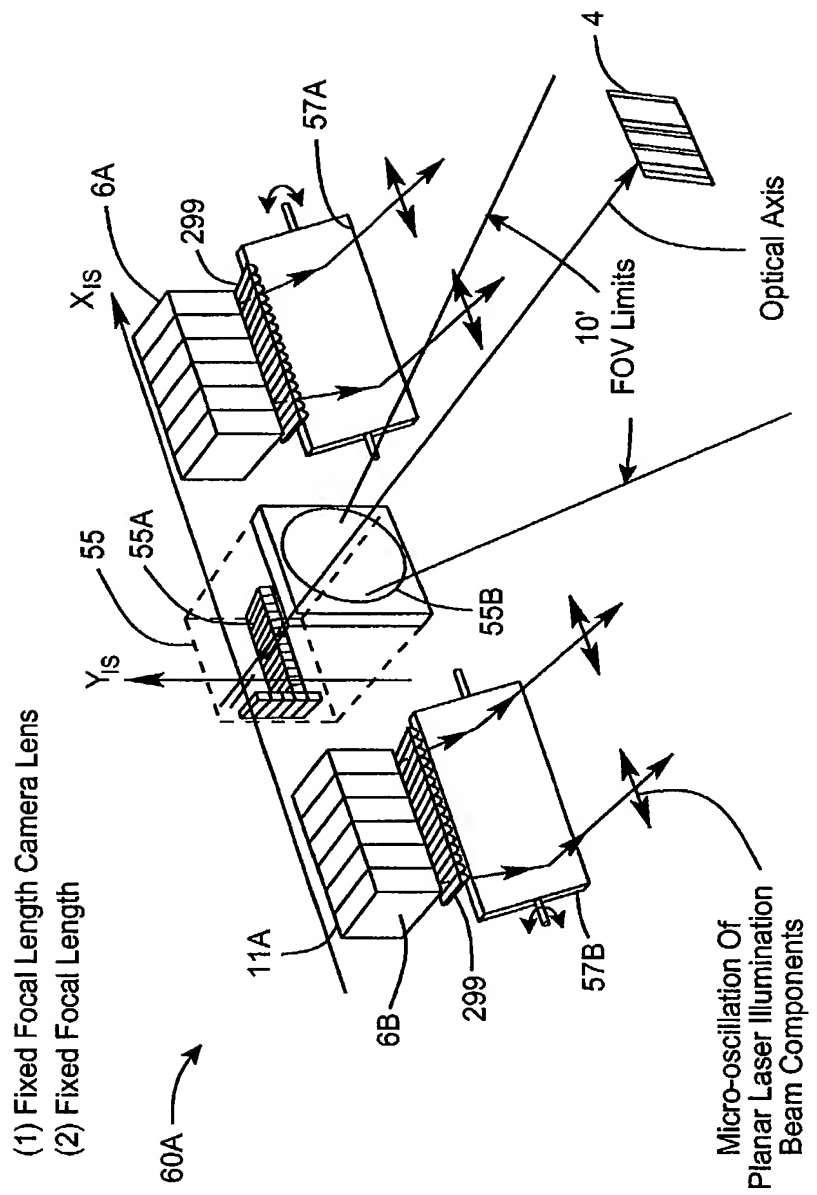
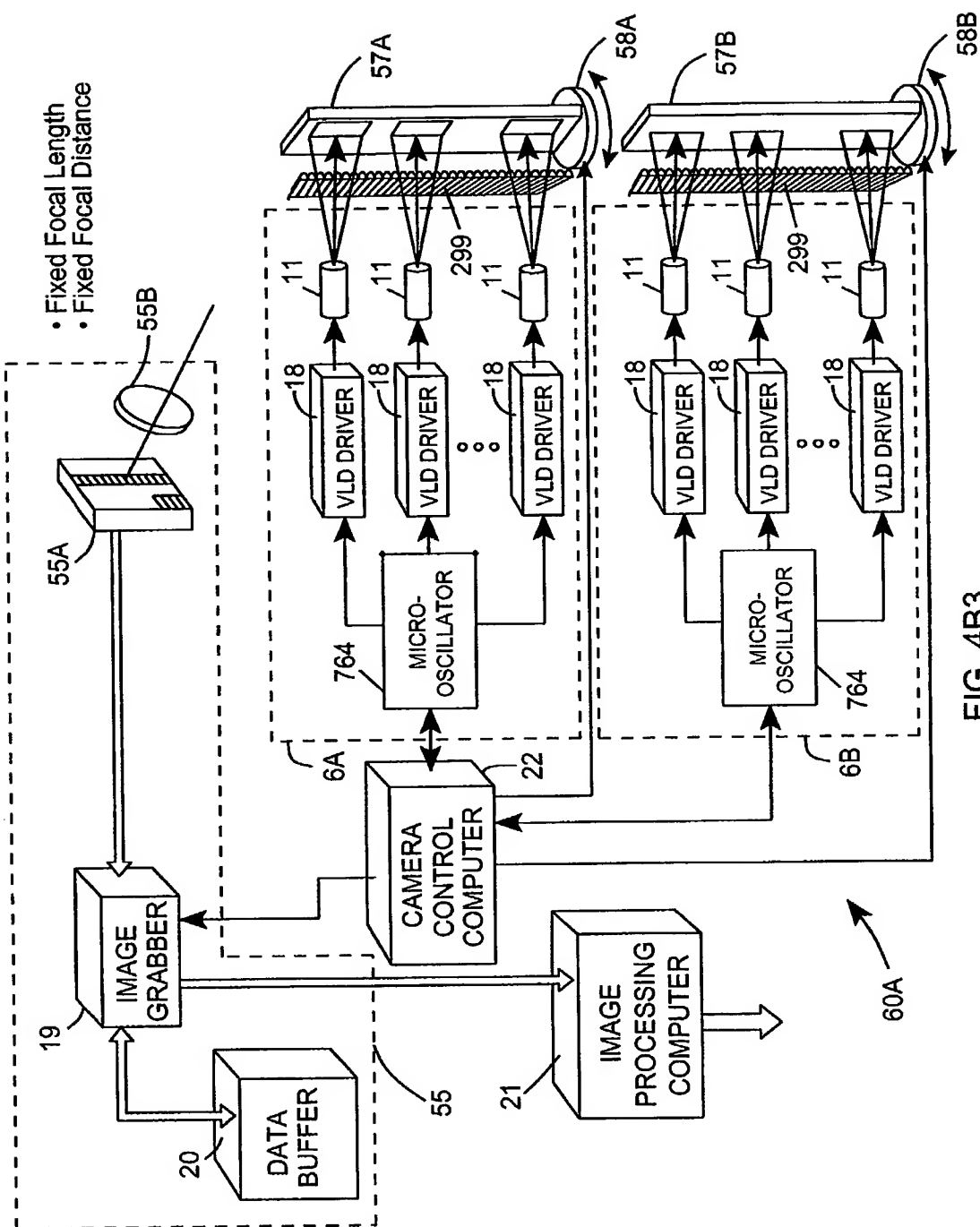


FIG. 4B2



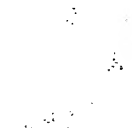


FIG. 4C1

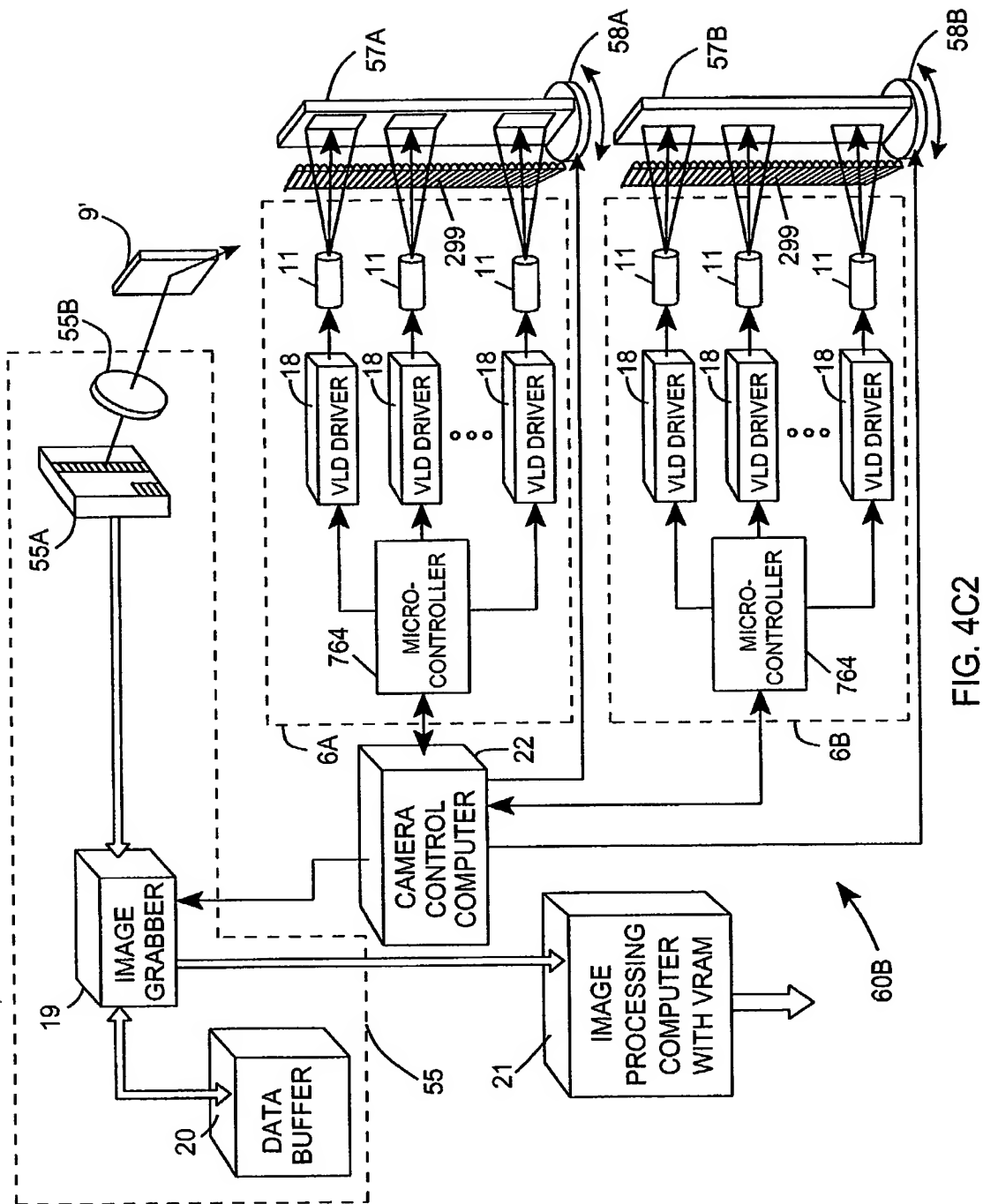
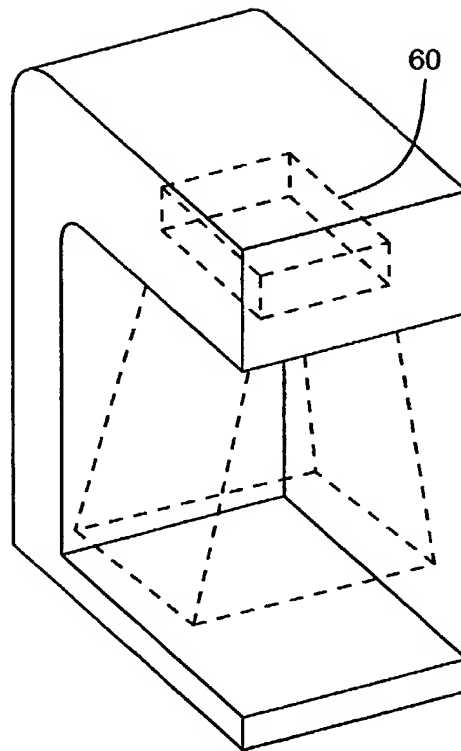
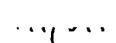


FIG. 4C2



2-D Hold-under Scanner

FIG. 4D



\*\*\*\*\*

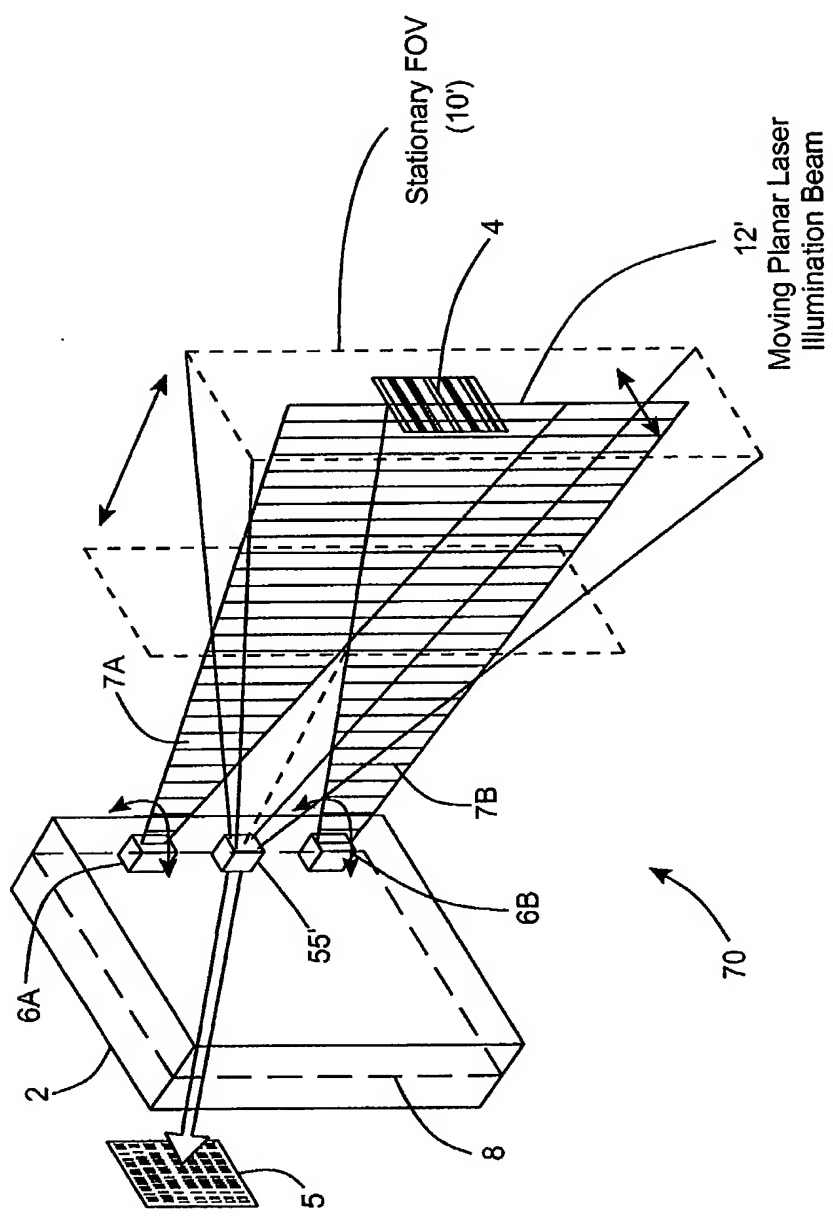


FIG. 5A



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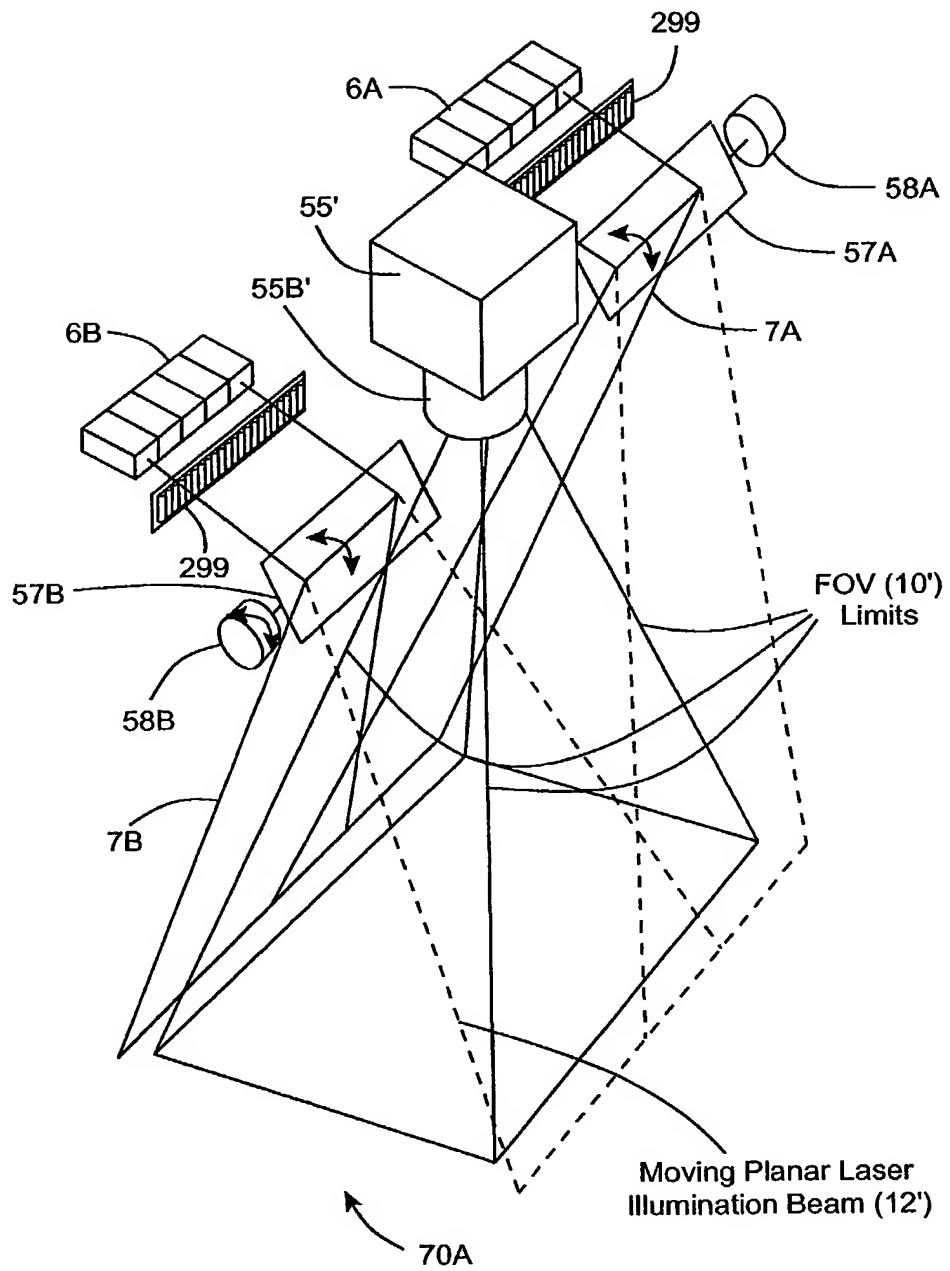


FIG. 5B1

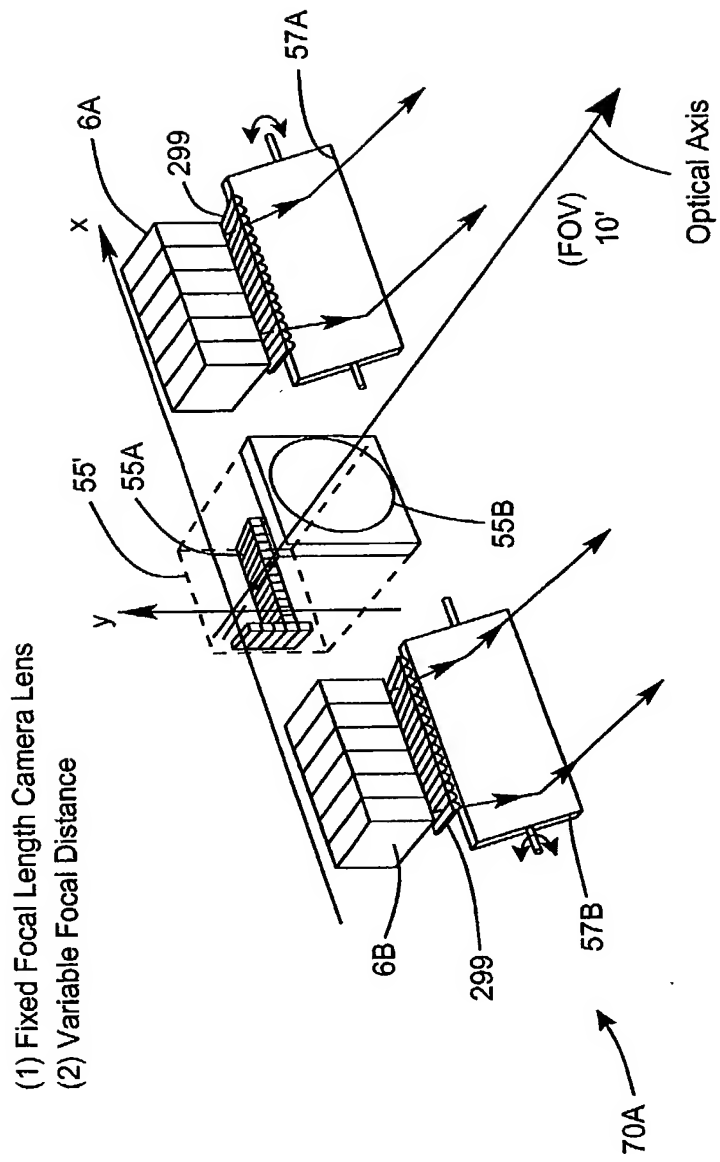


FIG. 5B2

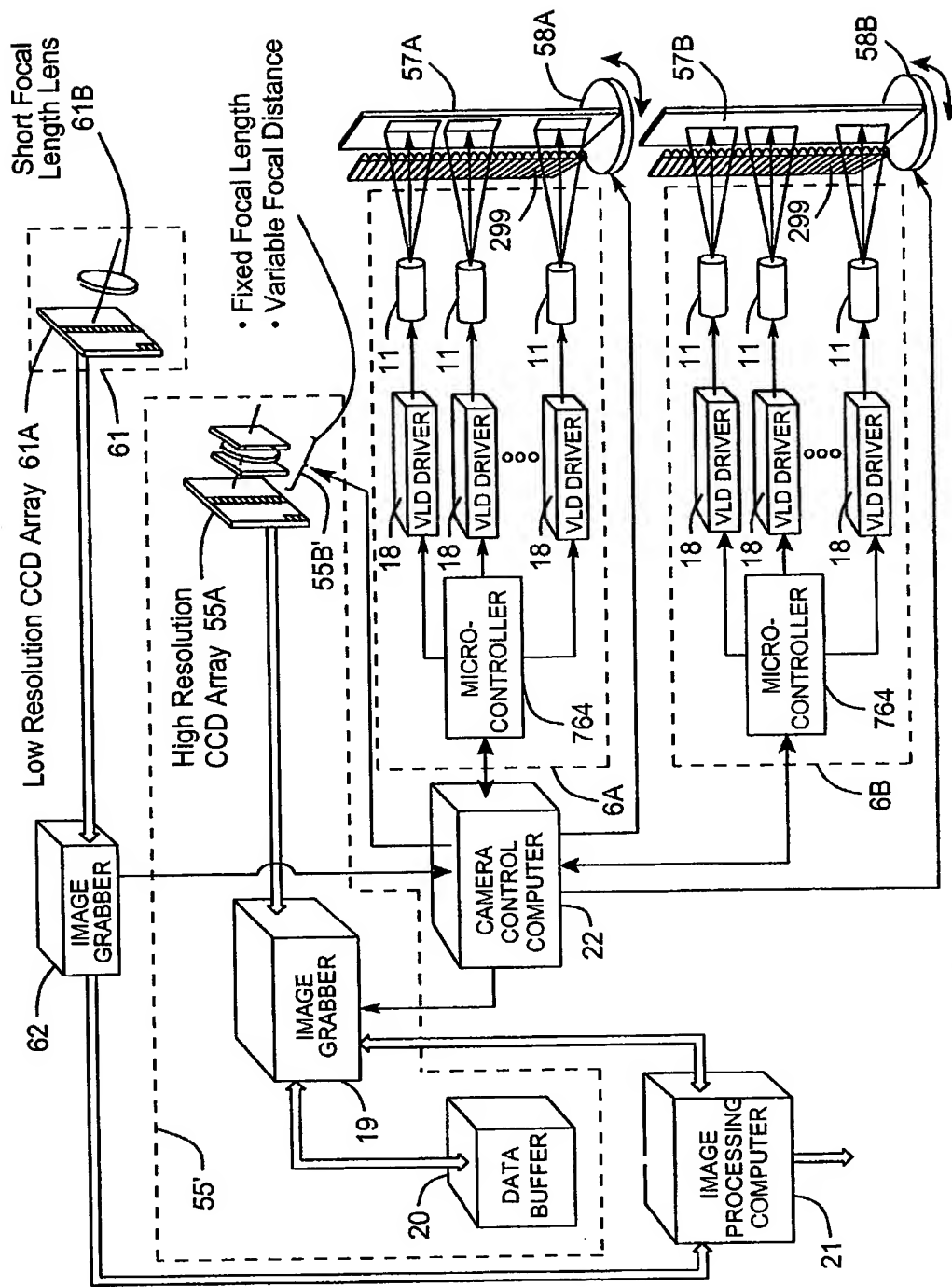


FIG. 5B3

70A

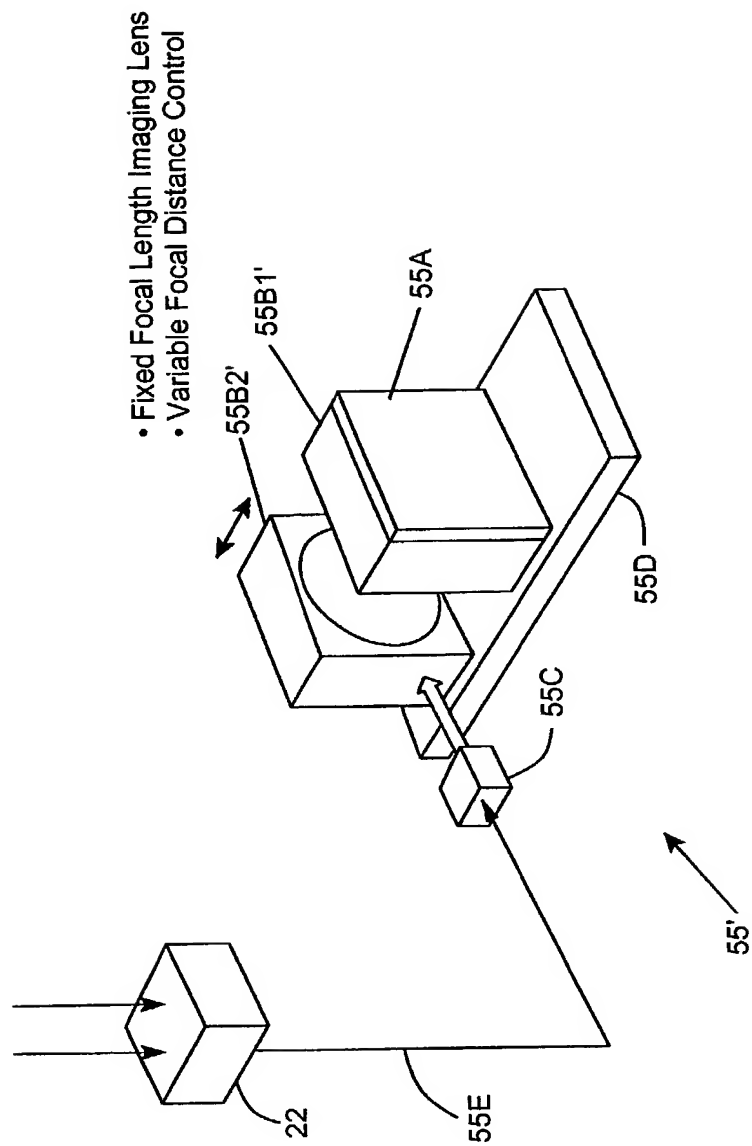


FIG. 5B4

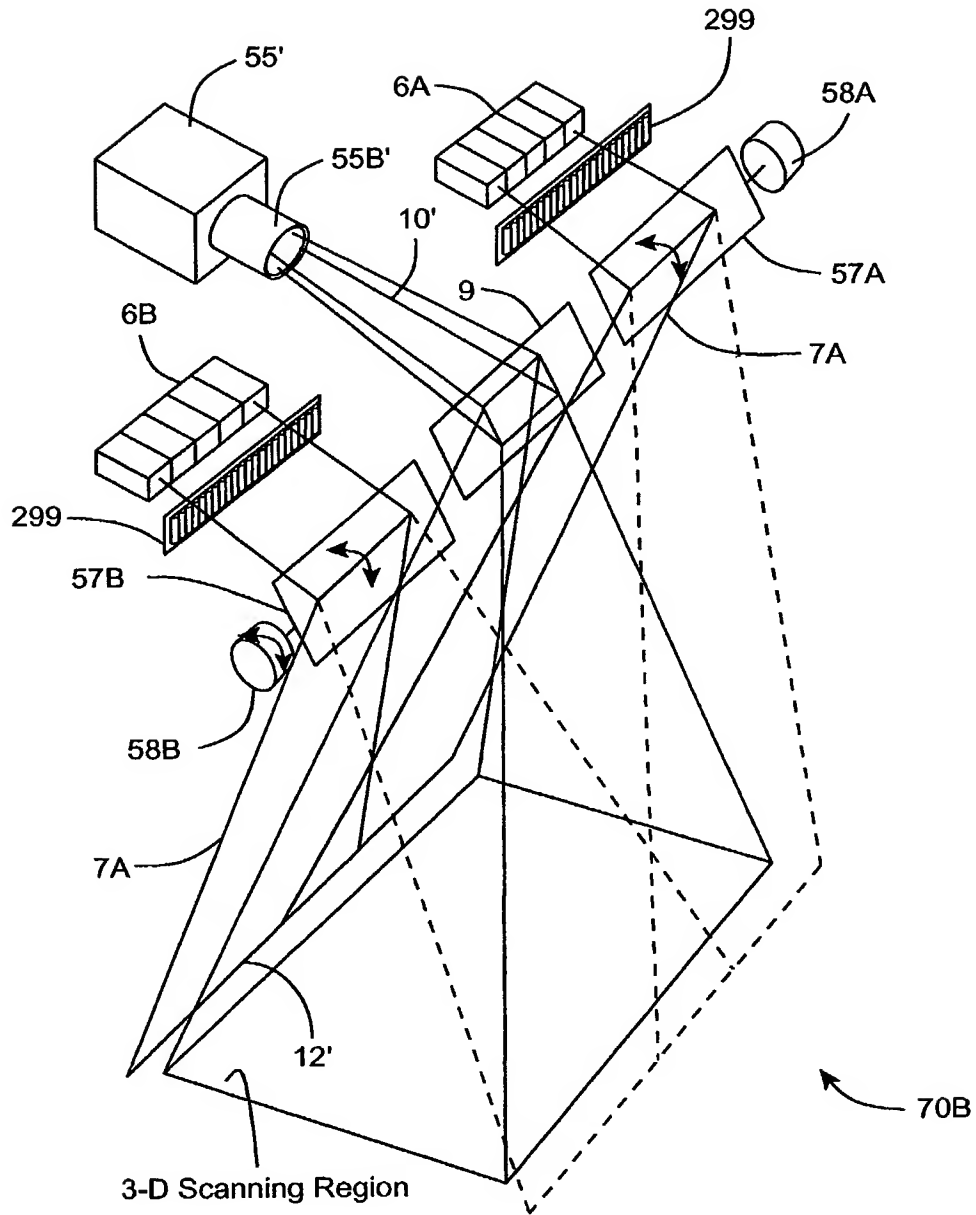


FIG. 5C1



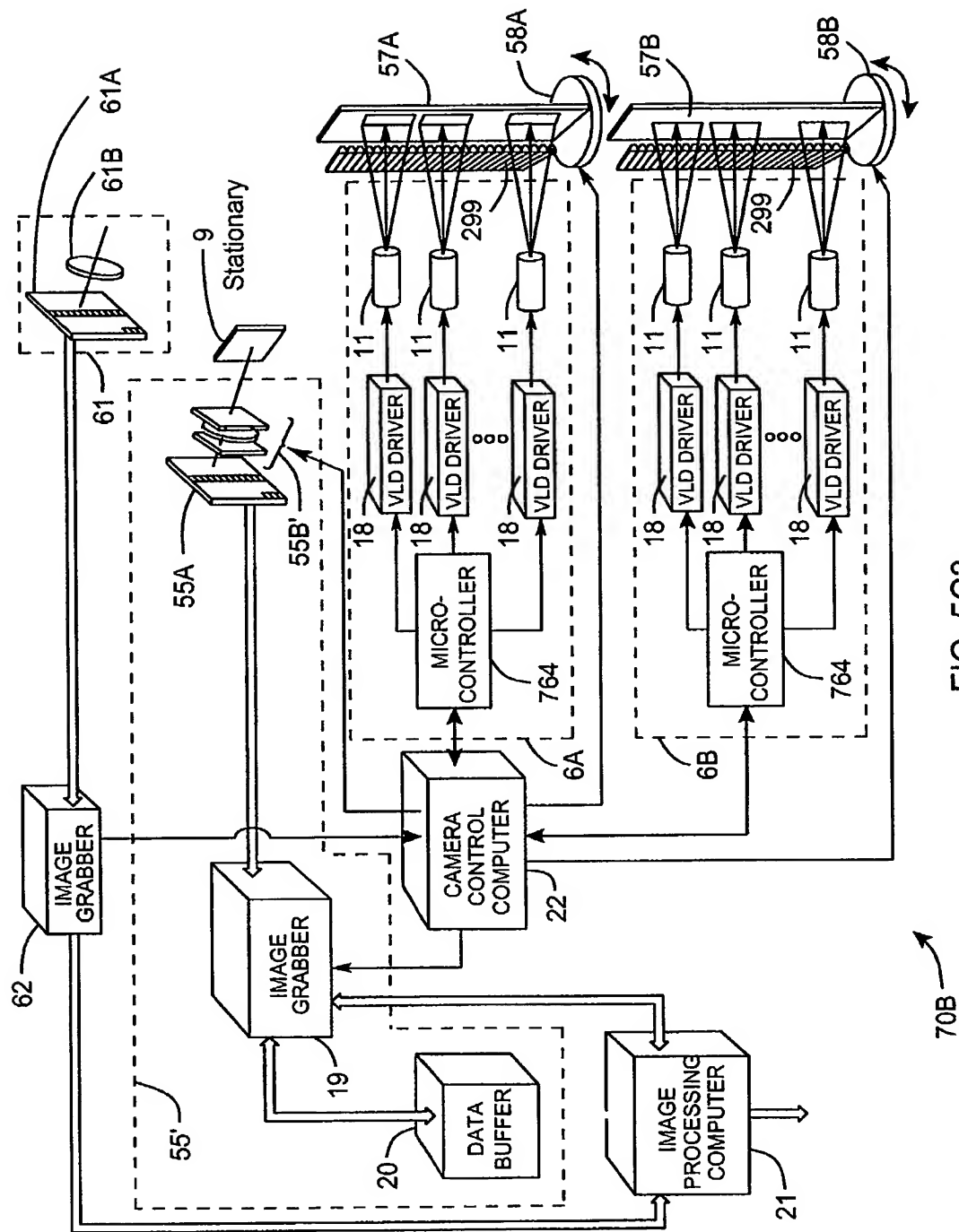


FIG. 5C3

70B

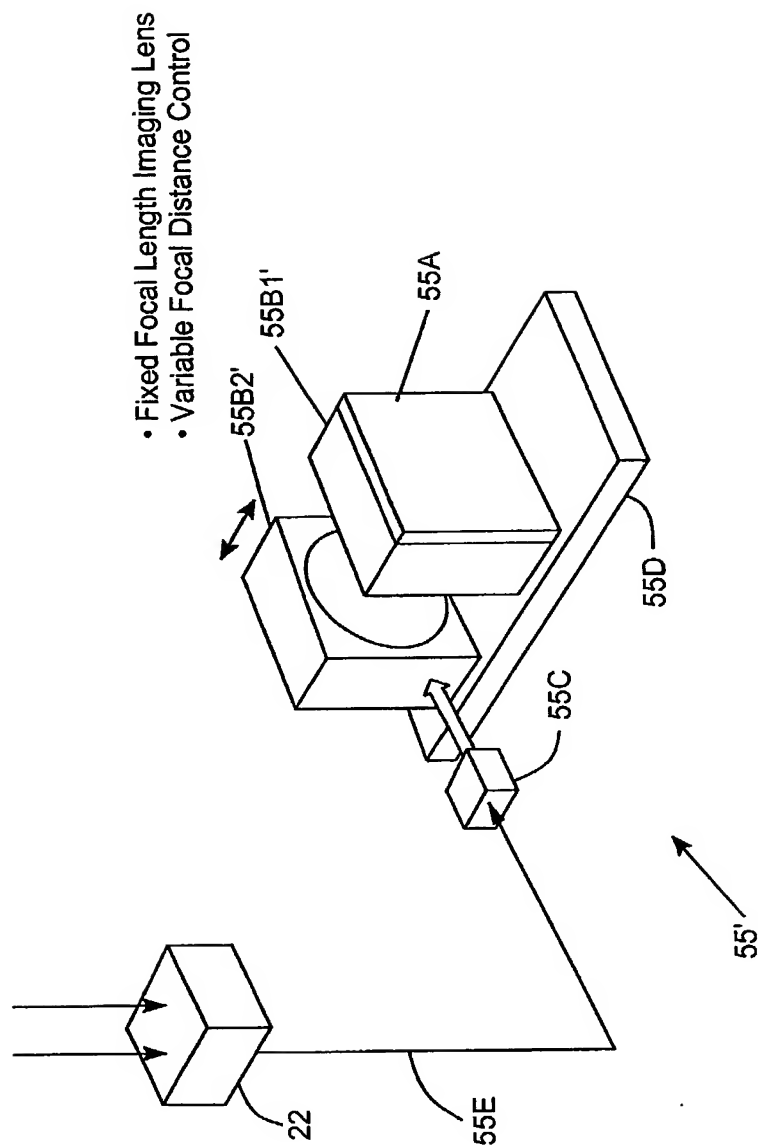


FIG. 5C4



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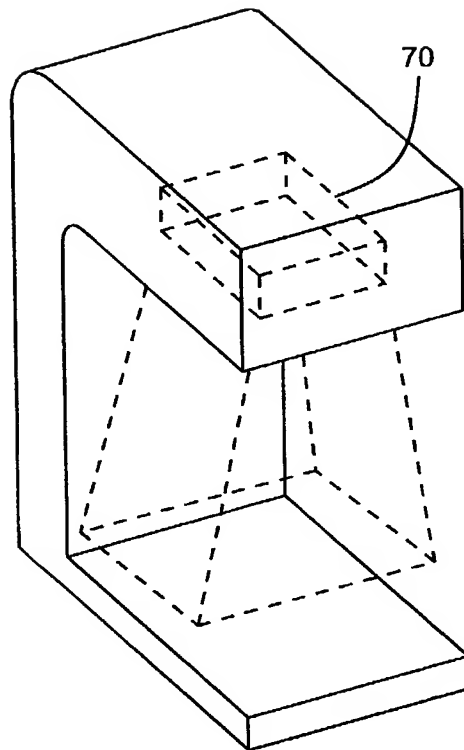


FIG. 5D

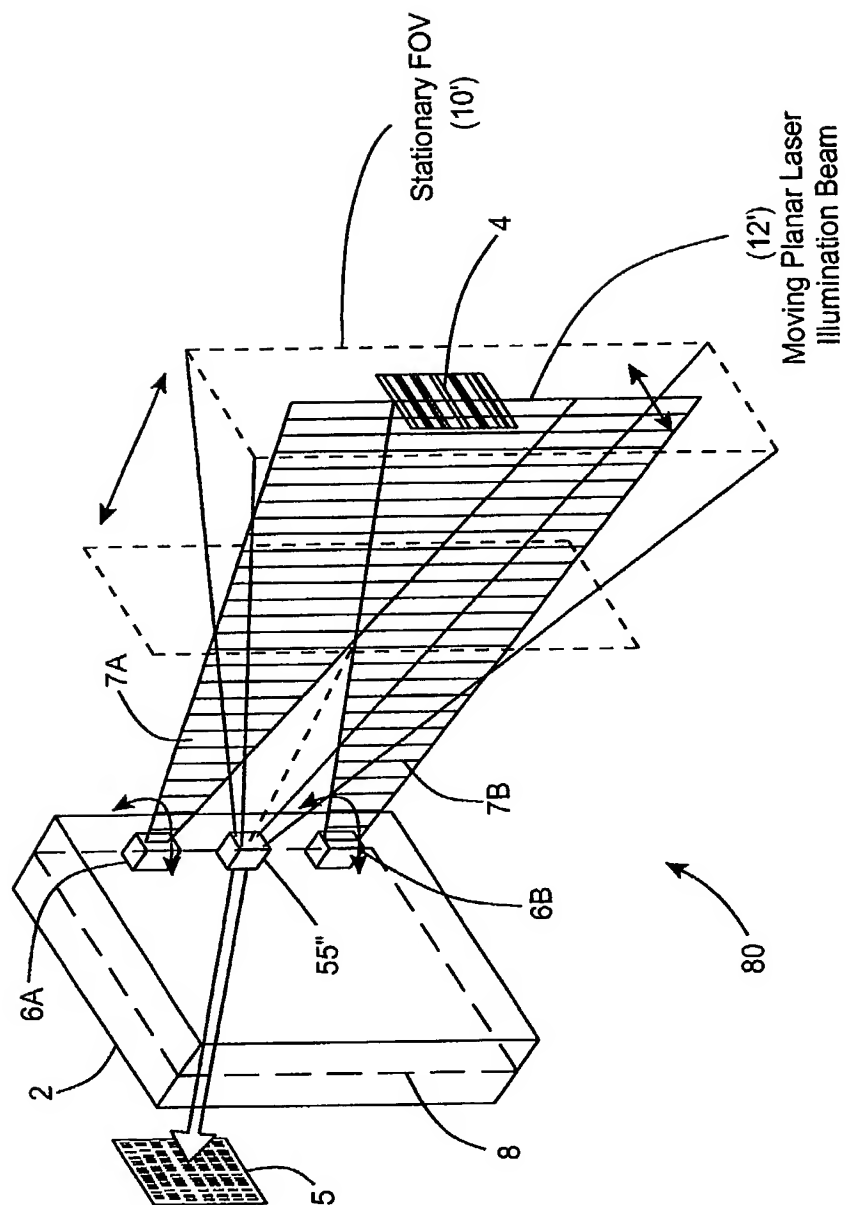


FIG. 6A

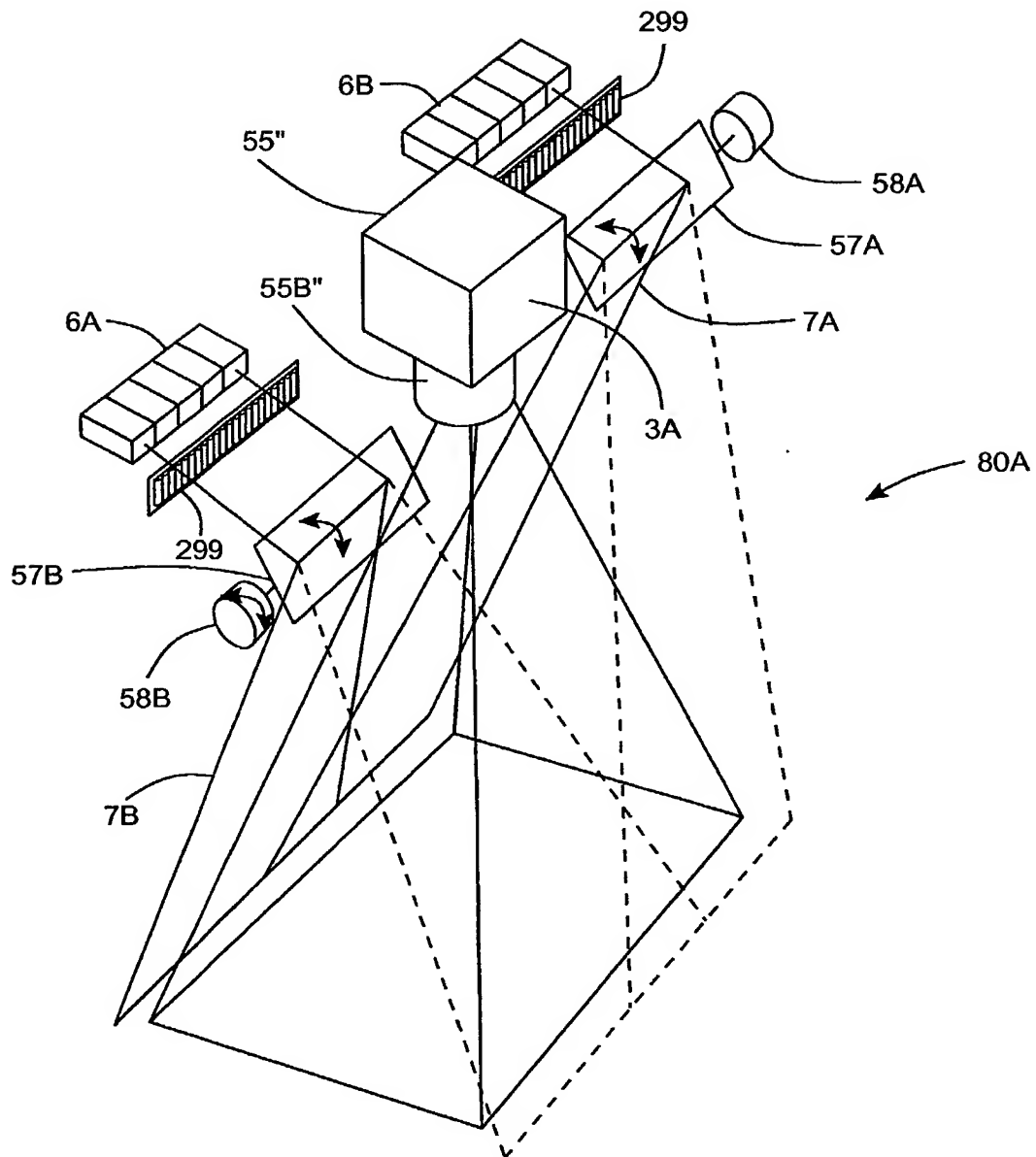


FIG. 6B1

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FIG. 6B2

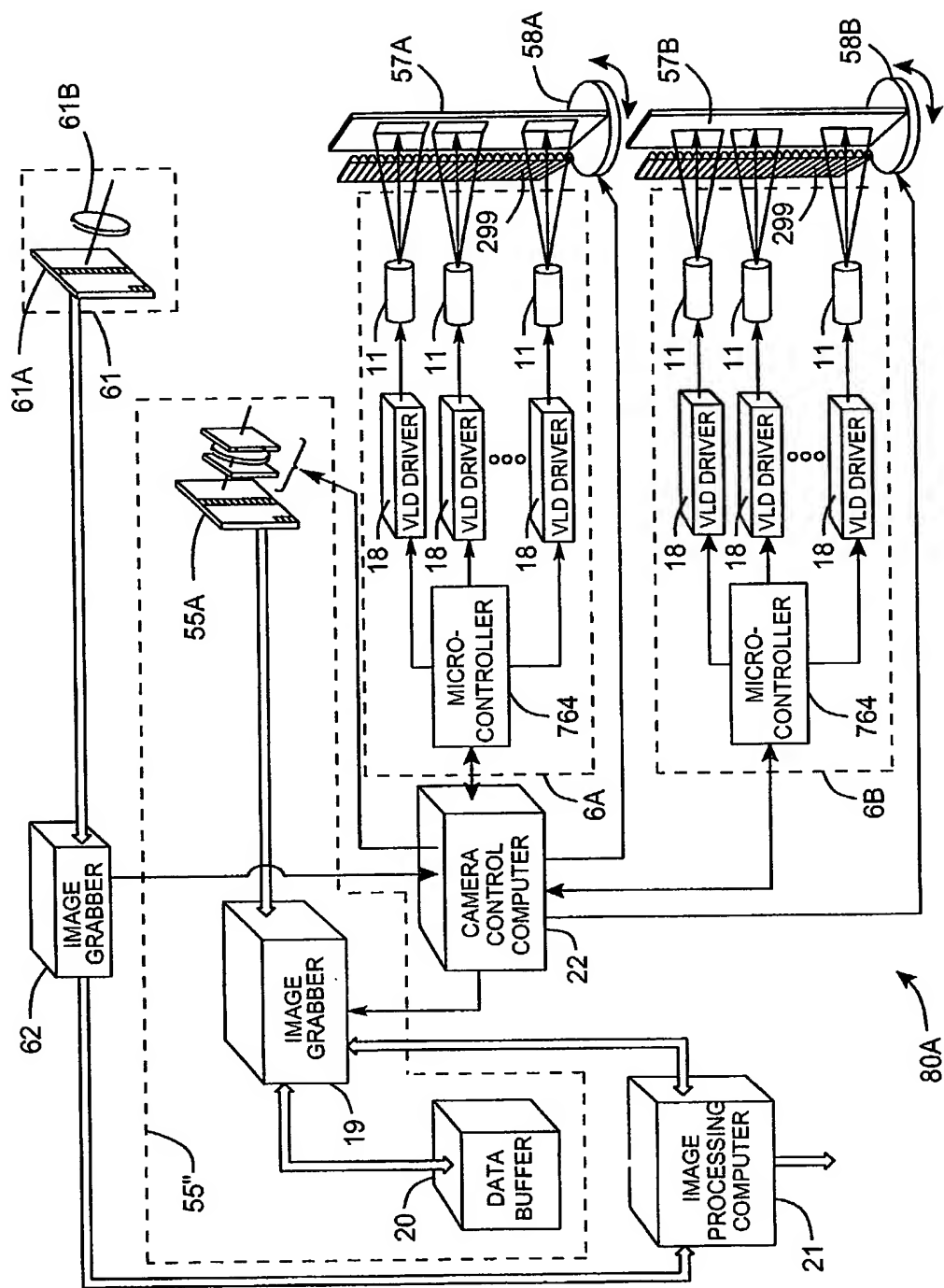


FIG. 6B3

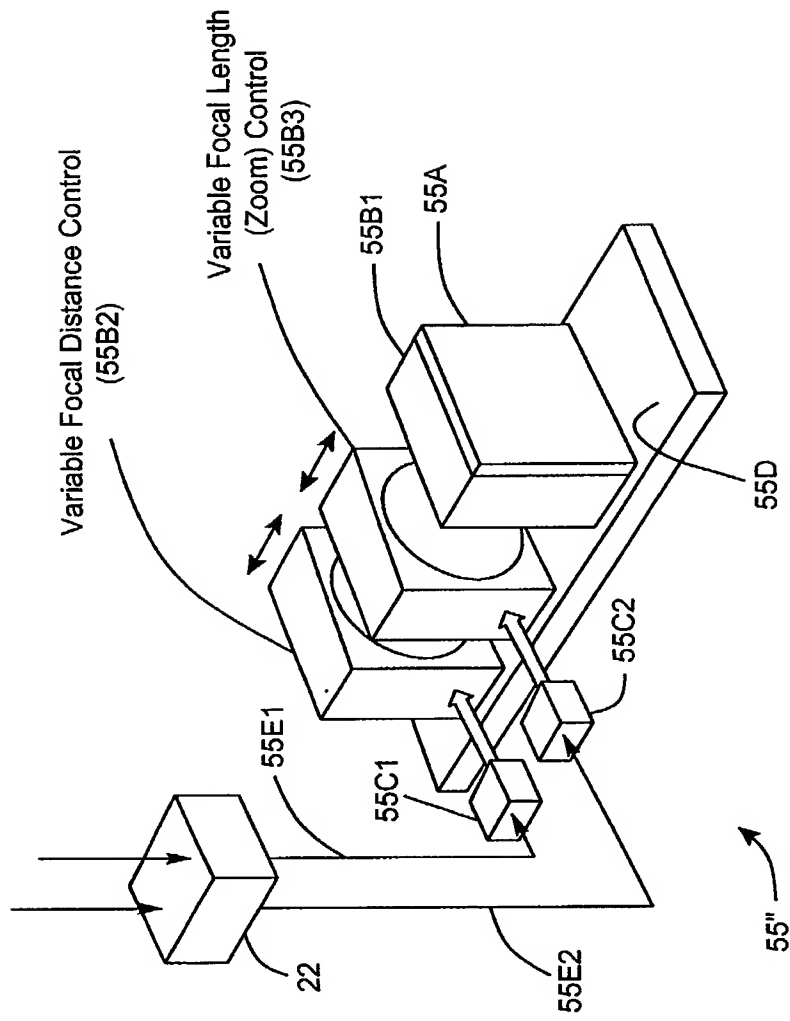


FIG. 6B4

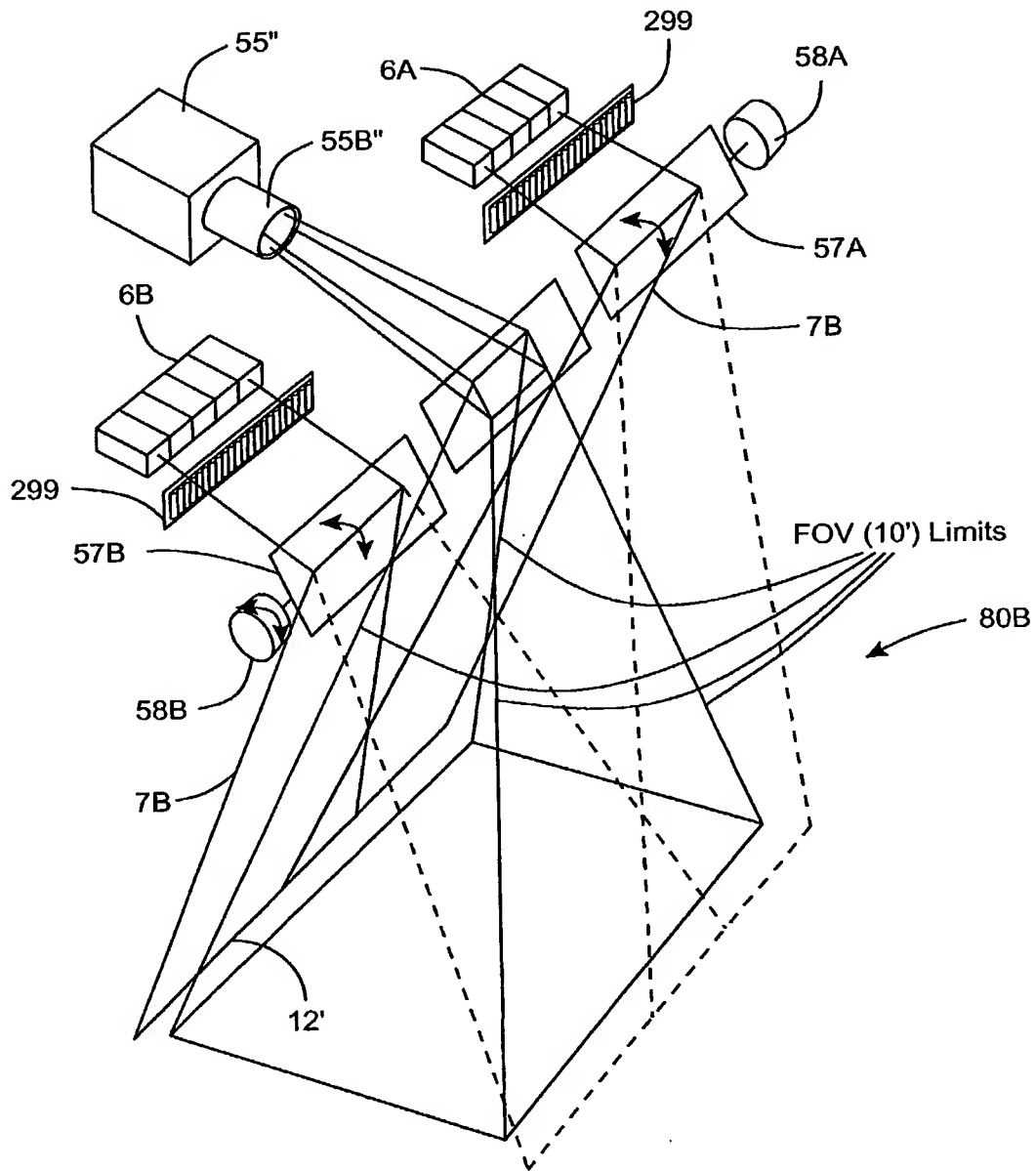


FIG. 6C1

- (1) Variable Focal Length Camera Lens
- (2) Variable Focal Distance

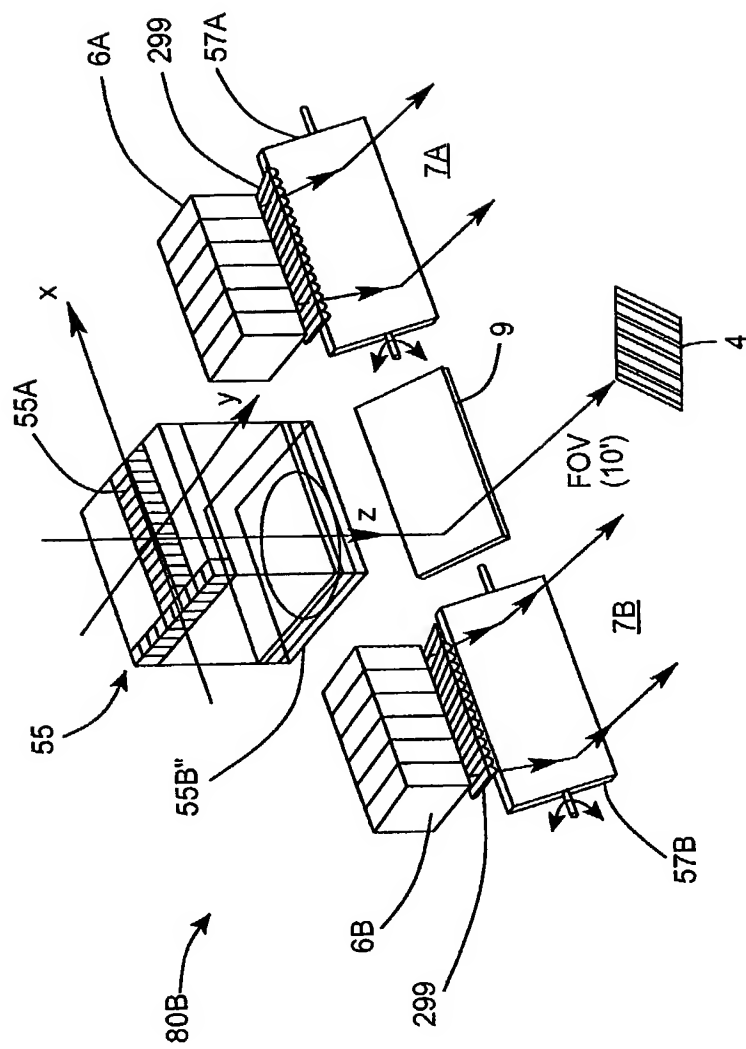


FIG. 6C2



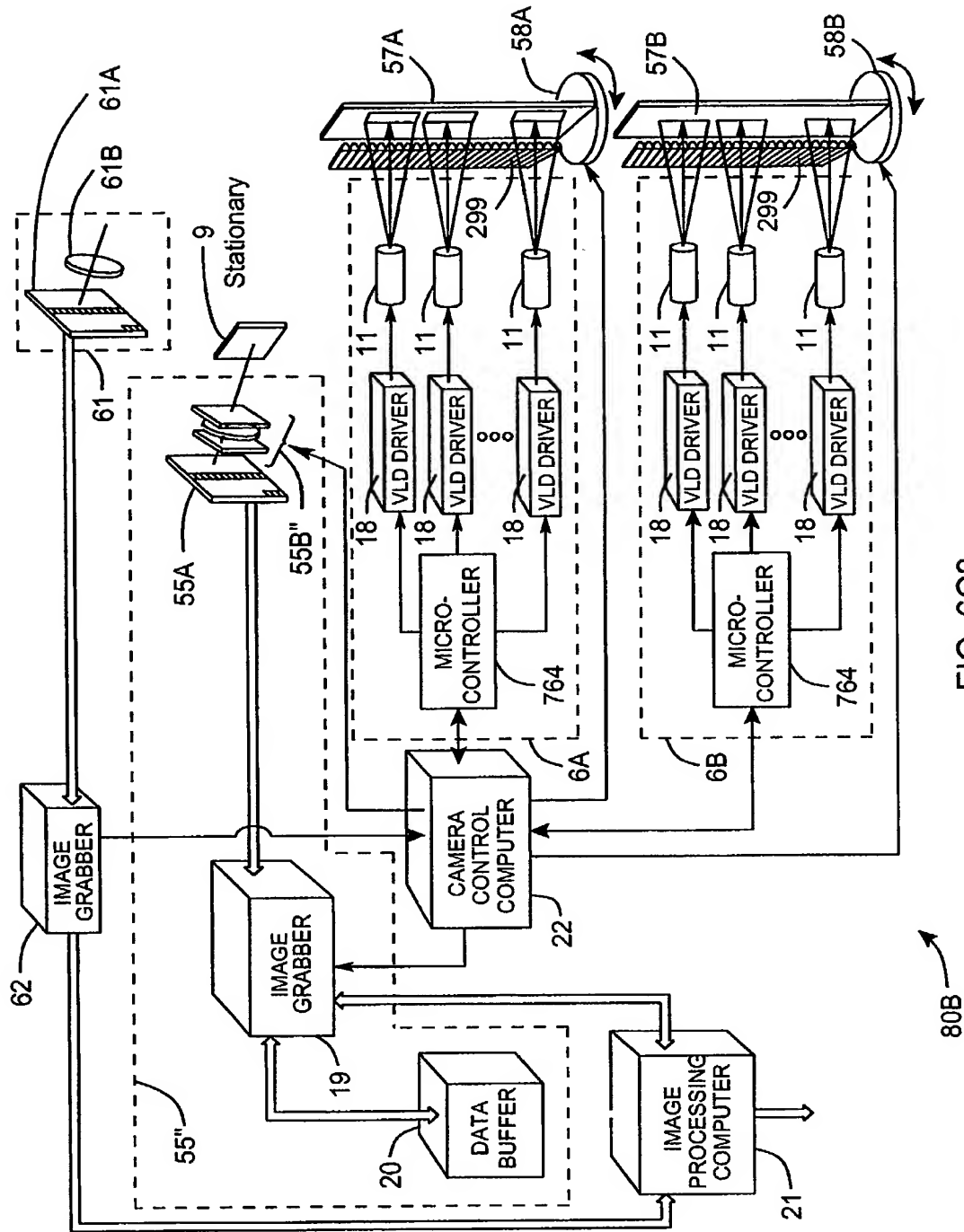


FIG. 6C3

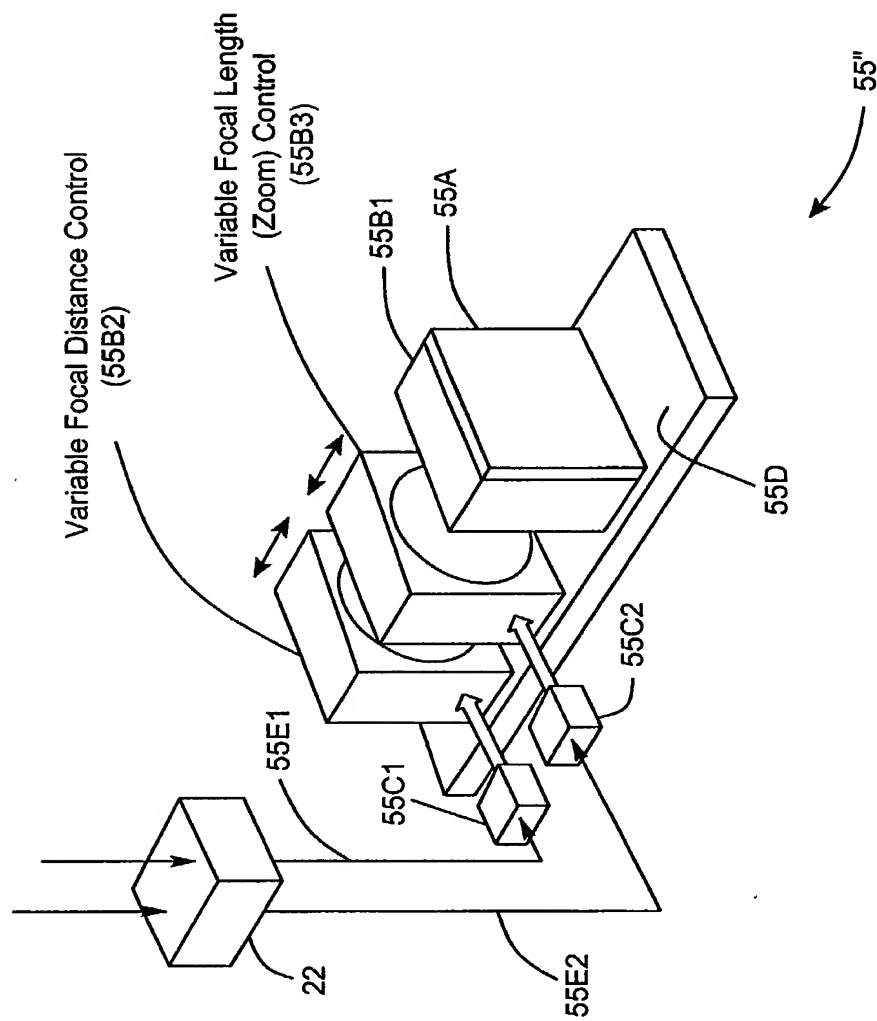


FIG. 6C4

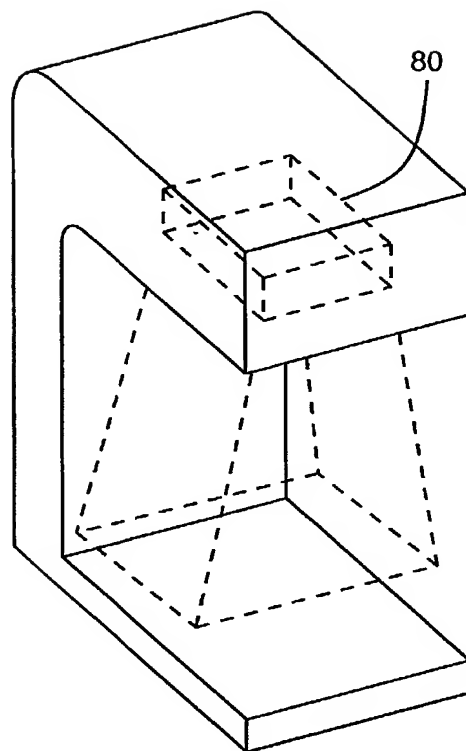


FIG. 6C5

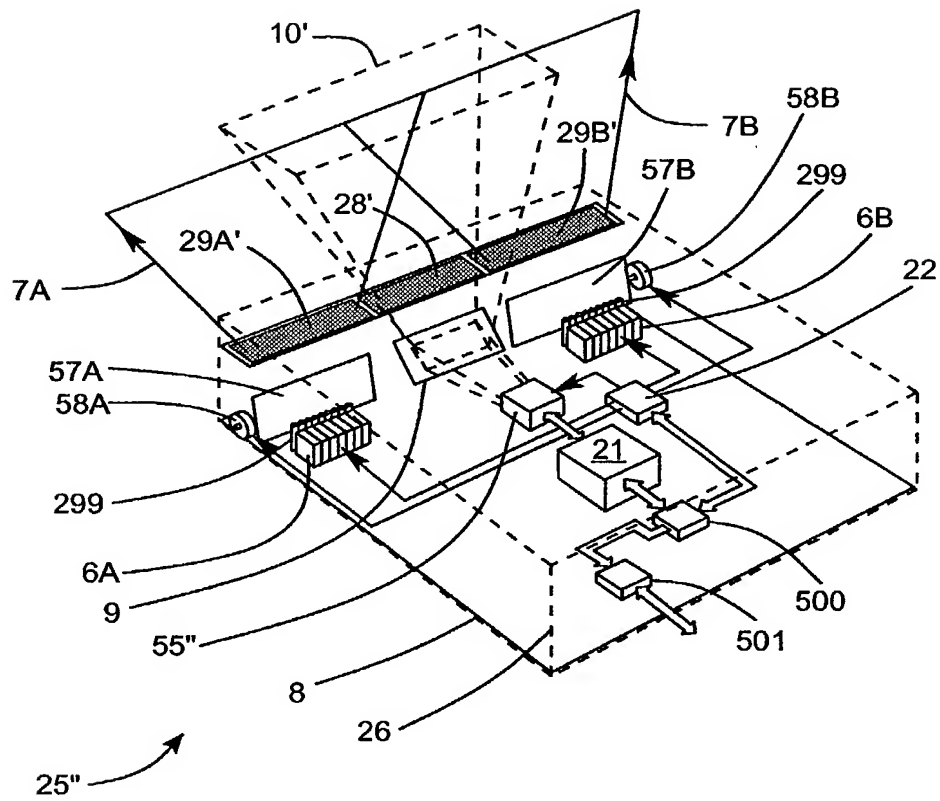


FIG. 6D1

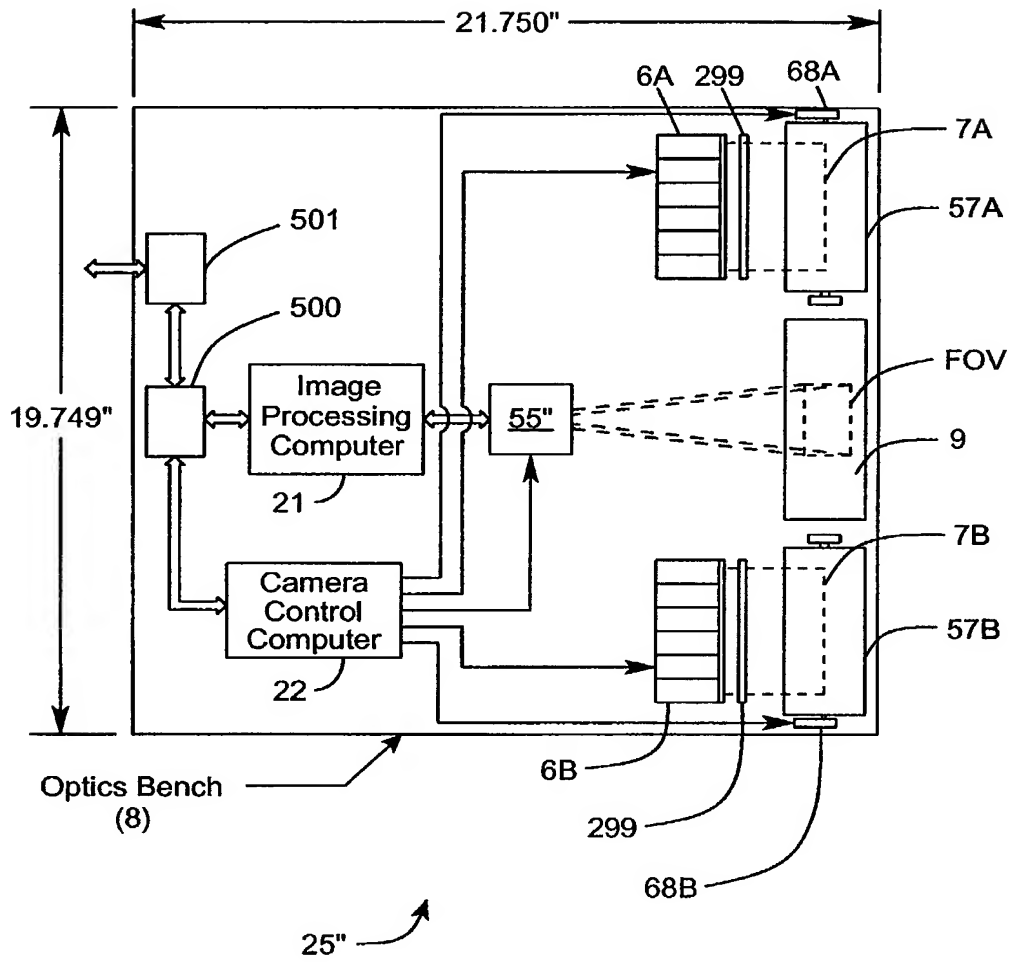


FIG. 6D2

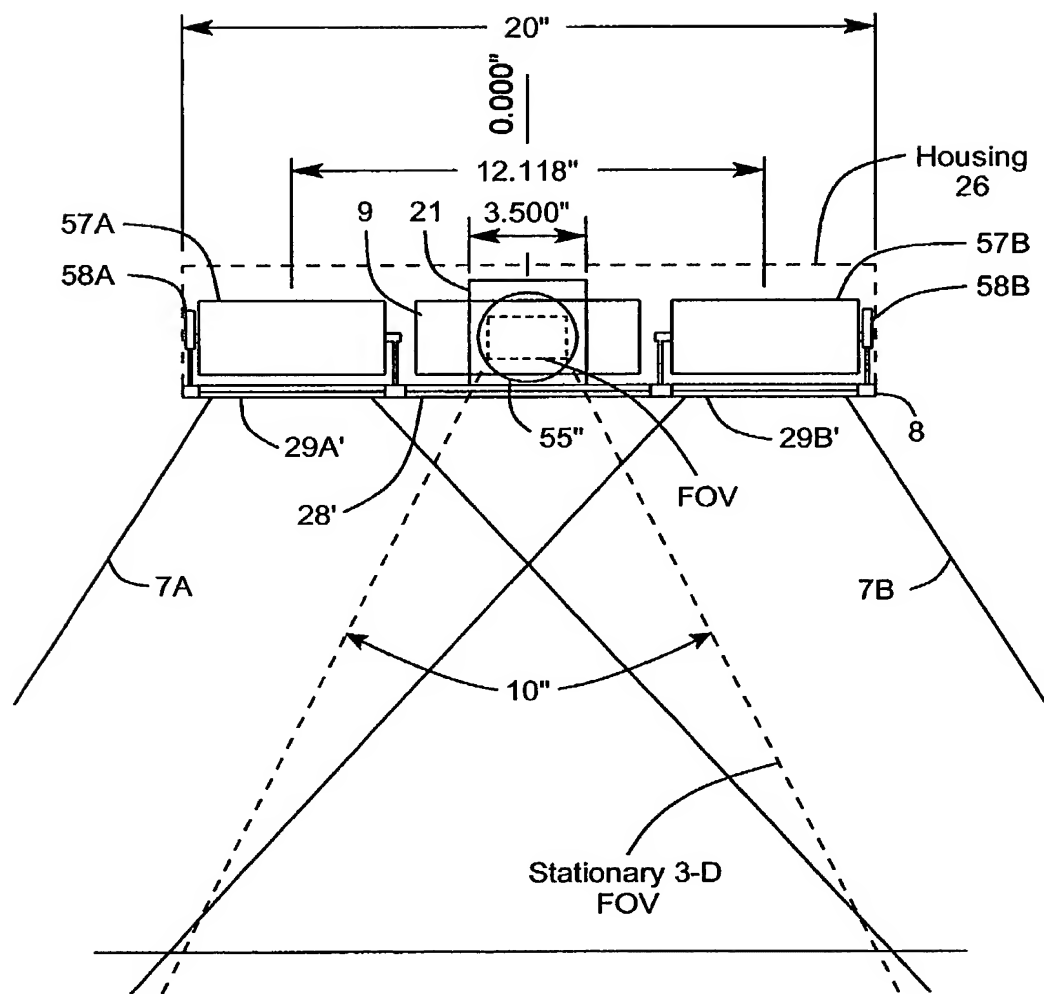


FIG. 6D3

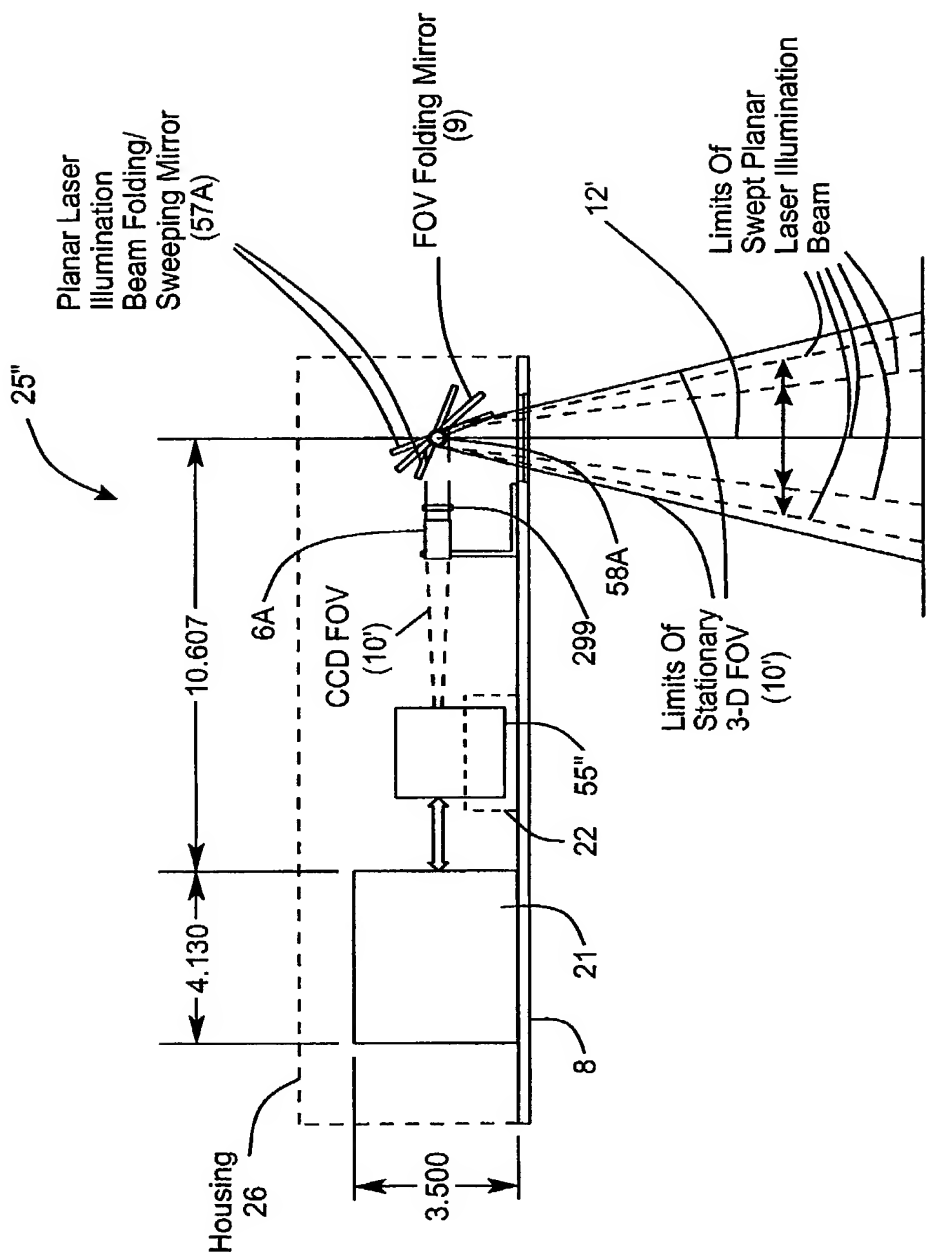


FIG. 6D4

\* Variable FOV

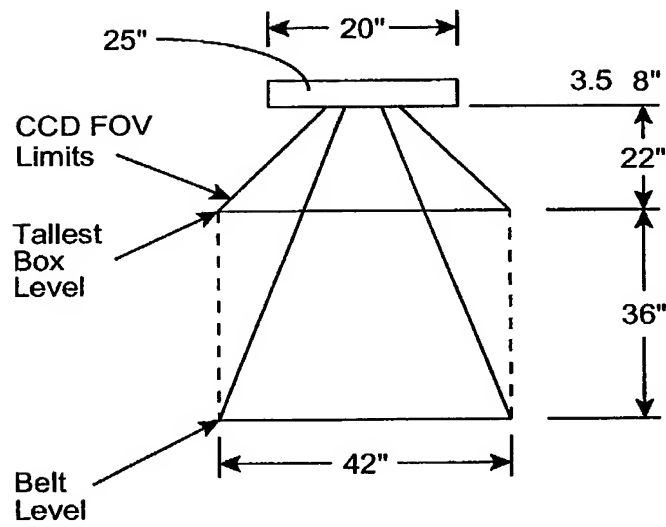


FIG. 6D5



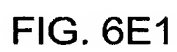


FIG. 6E1



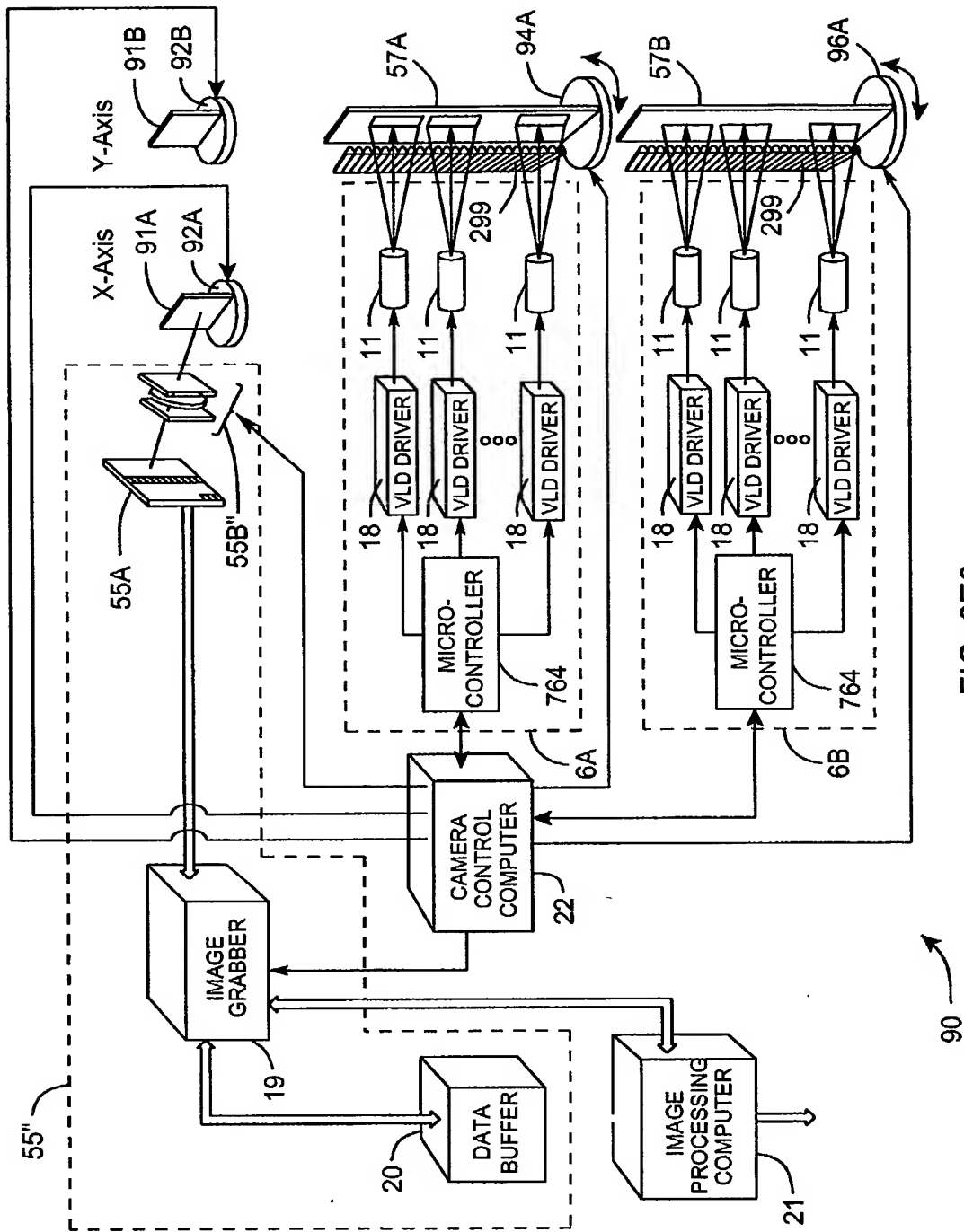


FIG. 6E3

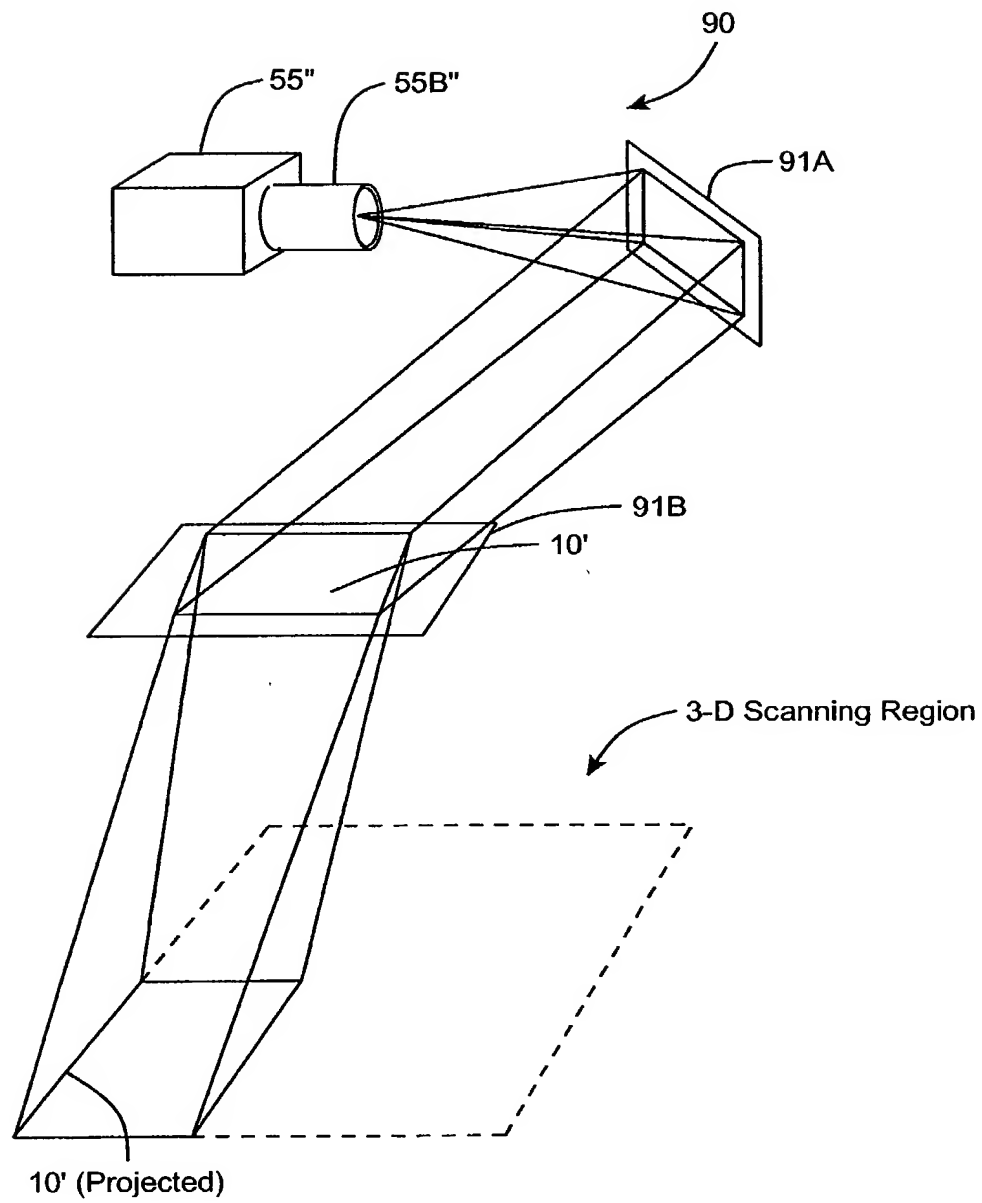
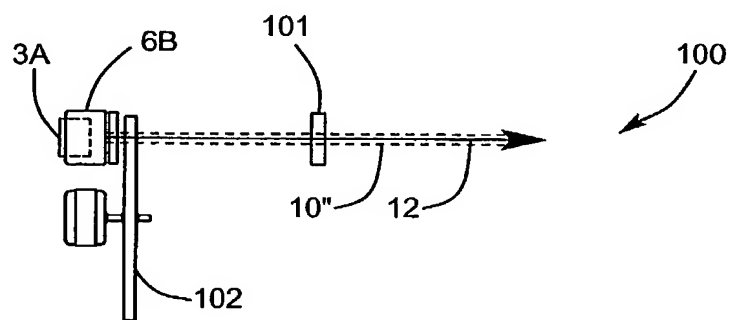
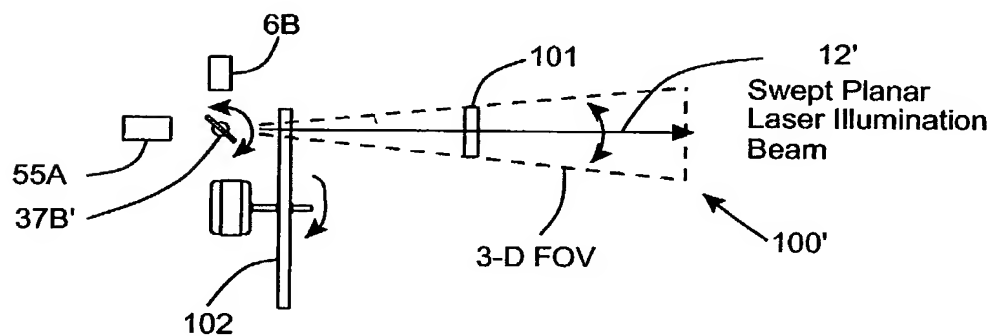


FIG. 6E4





1-D Scanner Embodiment

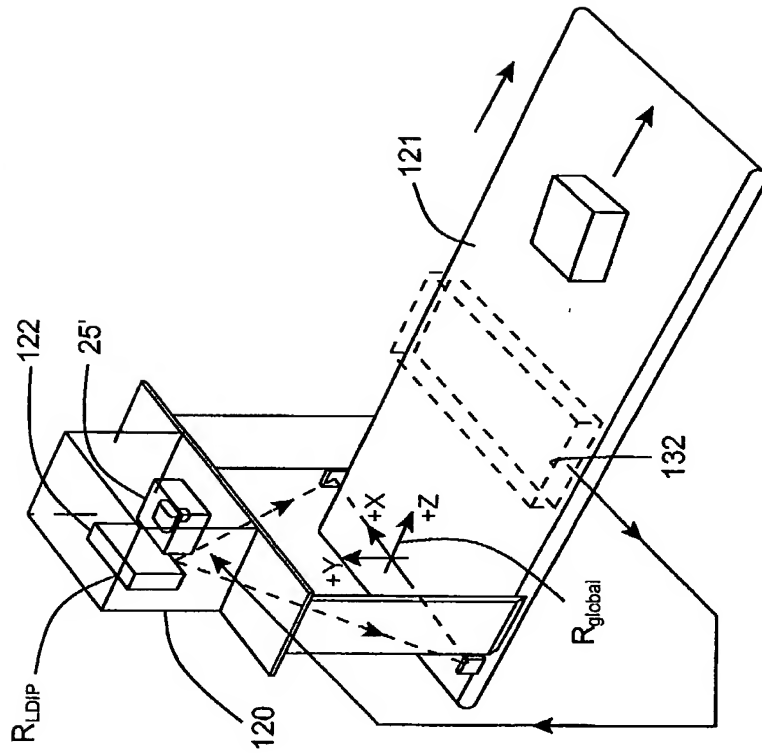


FIG. 9

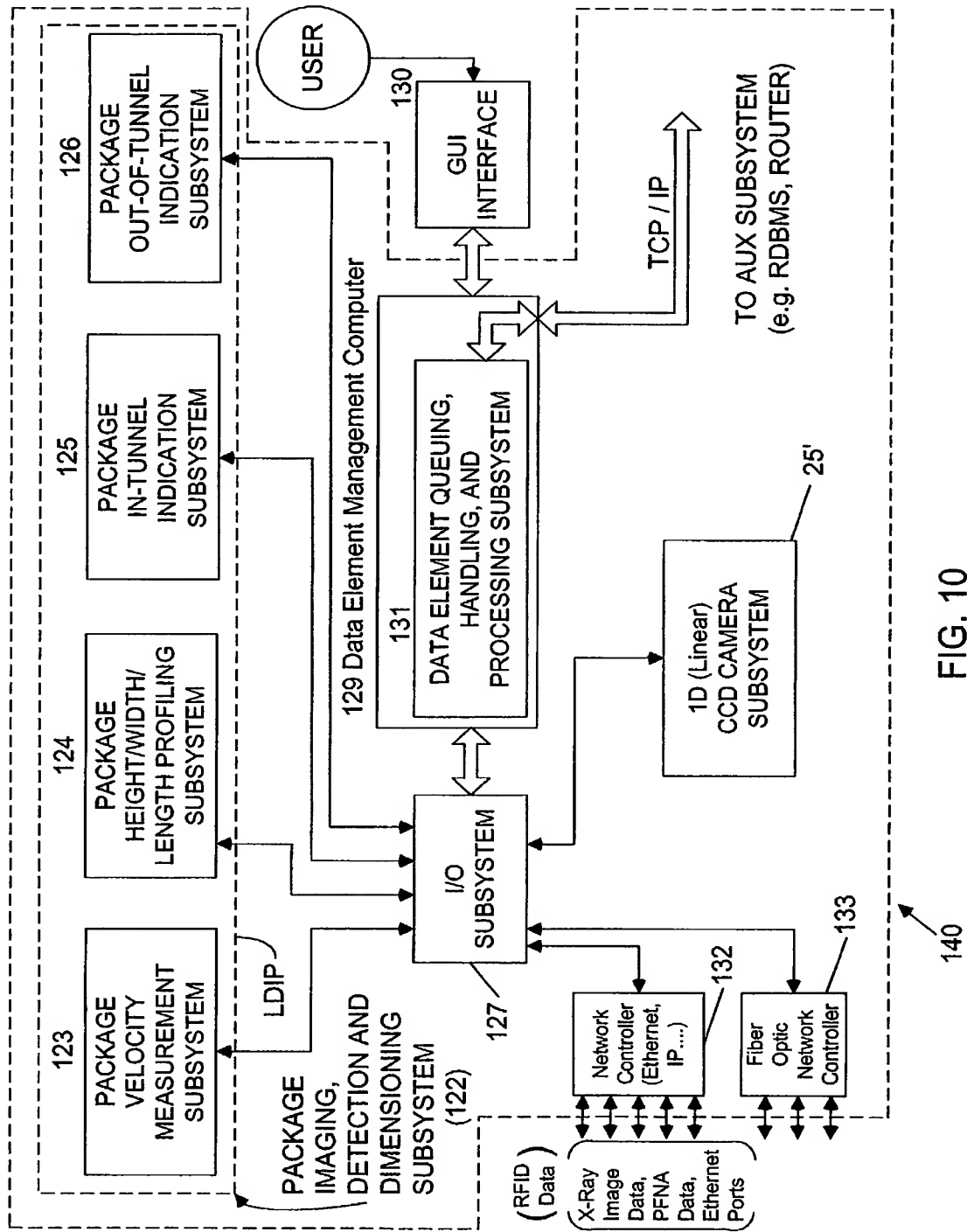


FIG. 10



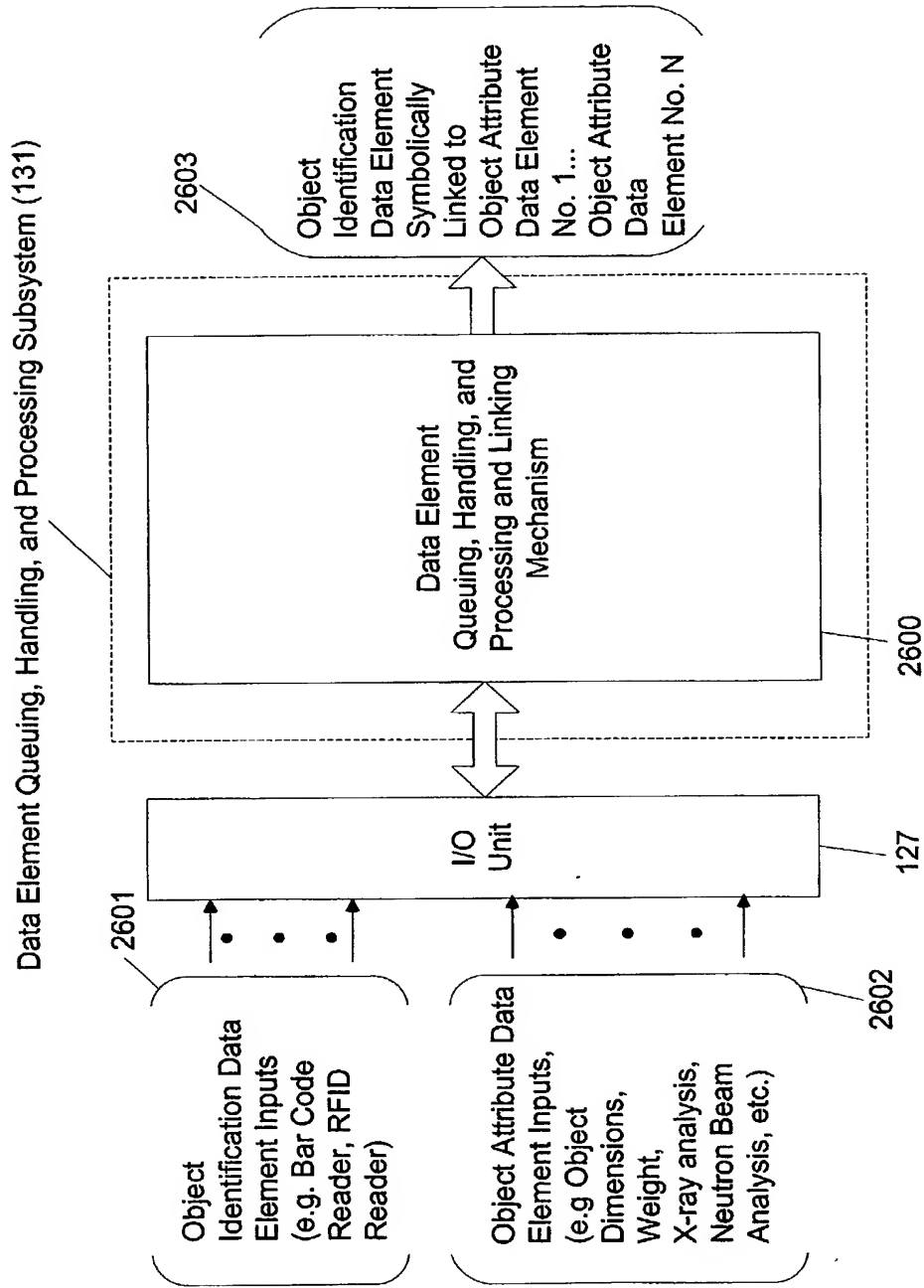


FIG. 10A

Primary Network and/or System Functions:

A. Specification of Object Detection and Tracking Capability of System

B. Specification of Object Identification Capability of System

C. Specification of Object Attribute Acquisition Capability of System

Specification of Object Detection, Tracking, and Identification and Attribute-Acquisition Capabilities of a Configured System or Network.

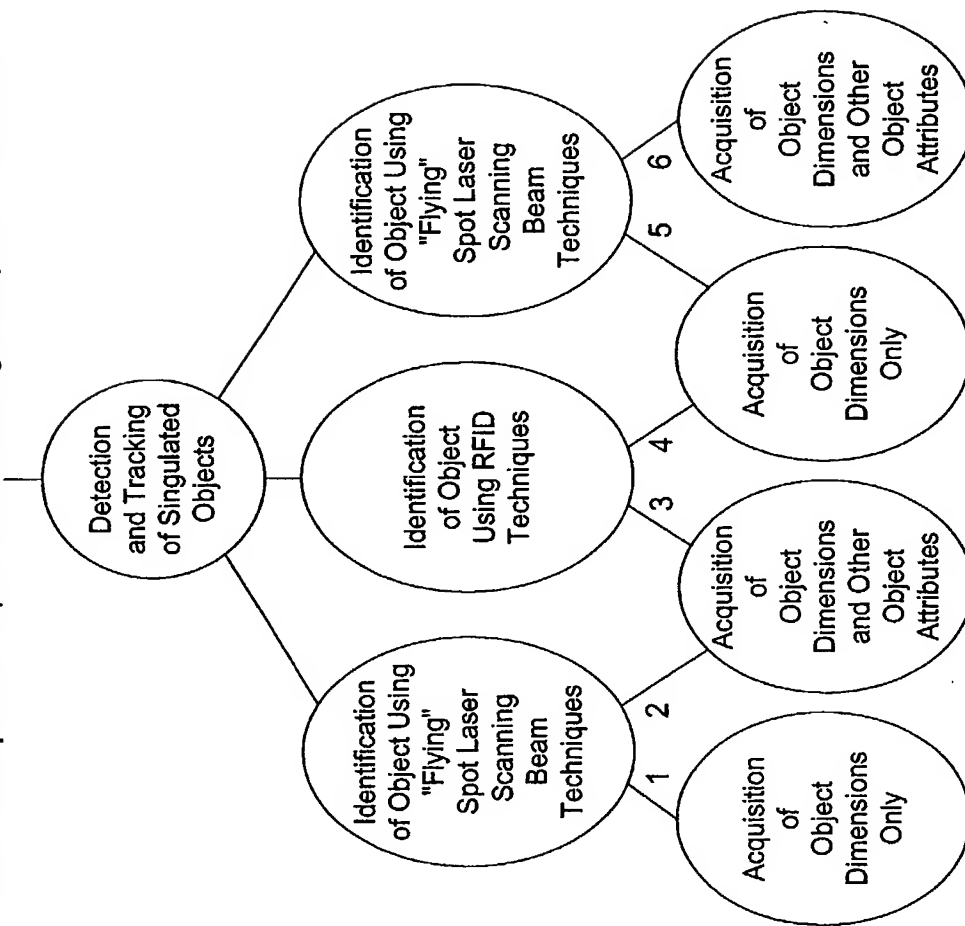


FIG. 10B-1

FIG. 10B-1

### A. Specification of Object Detection and Tracking Capability of System

### B. Specification of Object Identification Capability of System

C. Specification of Object Attribute Acquisition Capability of System

```

graph TD
    Root((Detection and Tracking of Non-Singulated Objects))
    Root --- Node1((Identification of Object Using "Flying" Spot Laser Scanning Beam Techniques))
    Root --- Node2((Identification of Object Using RFID Techniques))
    Root --- Node3((Identification of Object Using "Flying" Spot Laser Scanning Beam Techniques))
    Node1 --- Node1_1((Acquisition of Object Dimensions and Other Object Attributes))
    Node1 --- Node1_2((Acquisition of Object Dimensions Only))
    Node2 --- Node2_1((Acquisition of Object Dimensions and Other Object Attributes))
    Node2 --- Node2_2((Acquisition of Object Dimensions Only))
    Node3 --- Node3_1((Acquisition of Object Dimensions and Other Object Attributes))
    Node3 --- Node3_2((Acquisition of Object Dimensions Only))
    
```

7 8 9 10 11 12

**FIG. 10B-2**

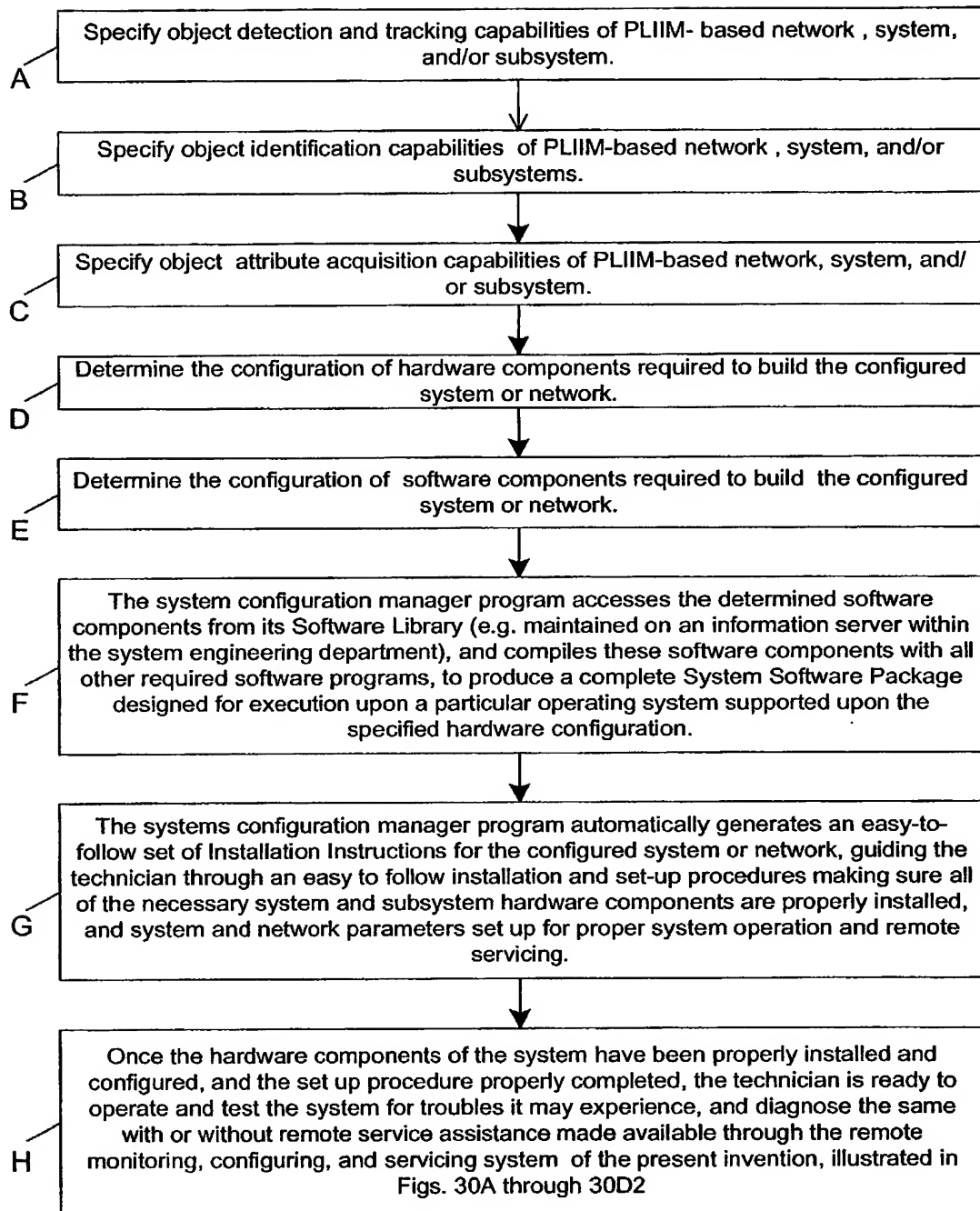


FIG. 10C

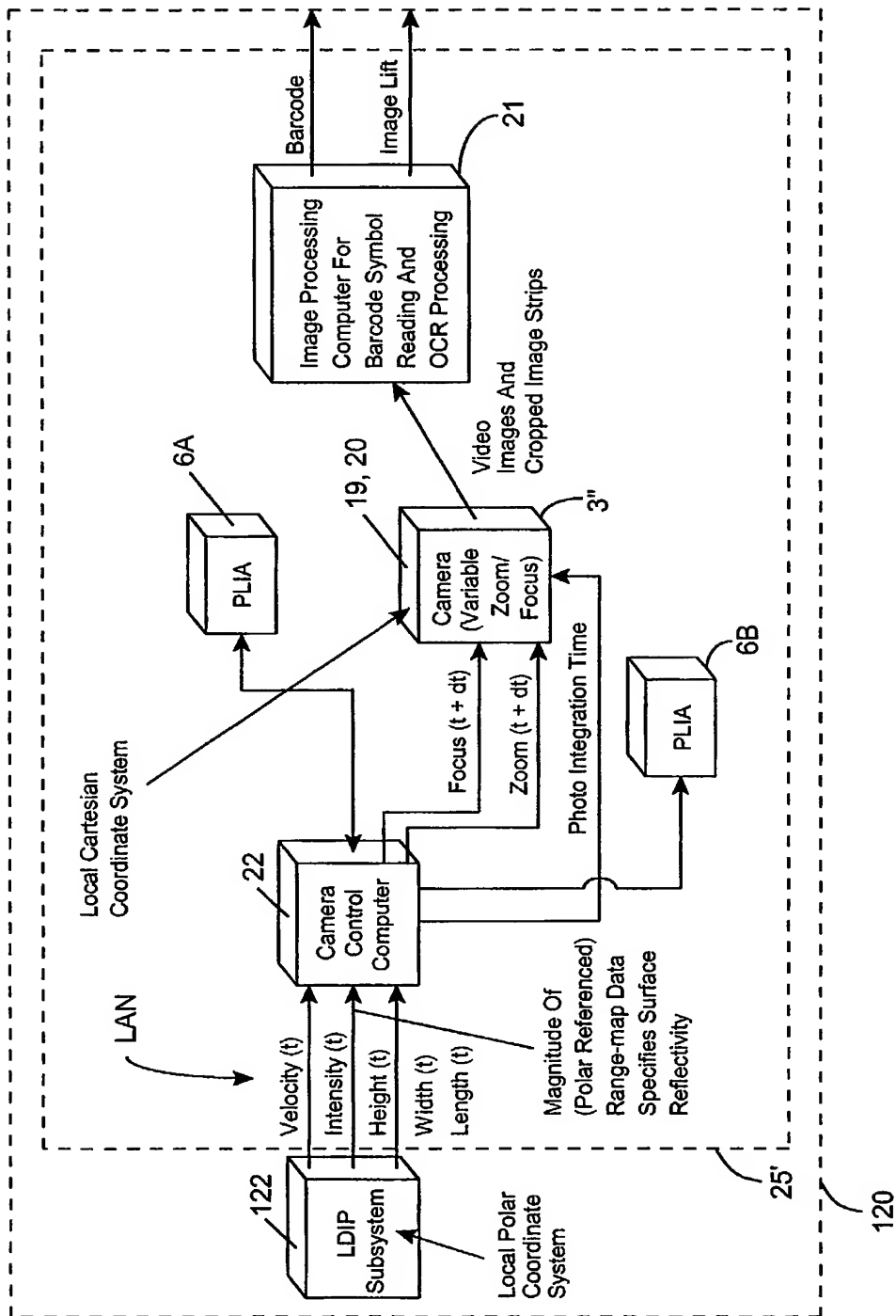


FIG. 11

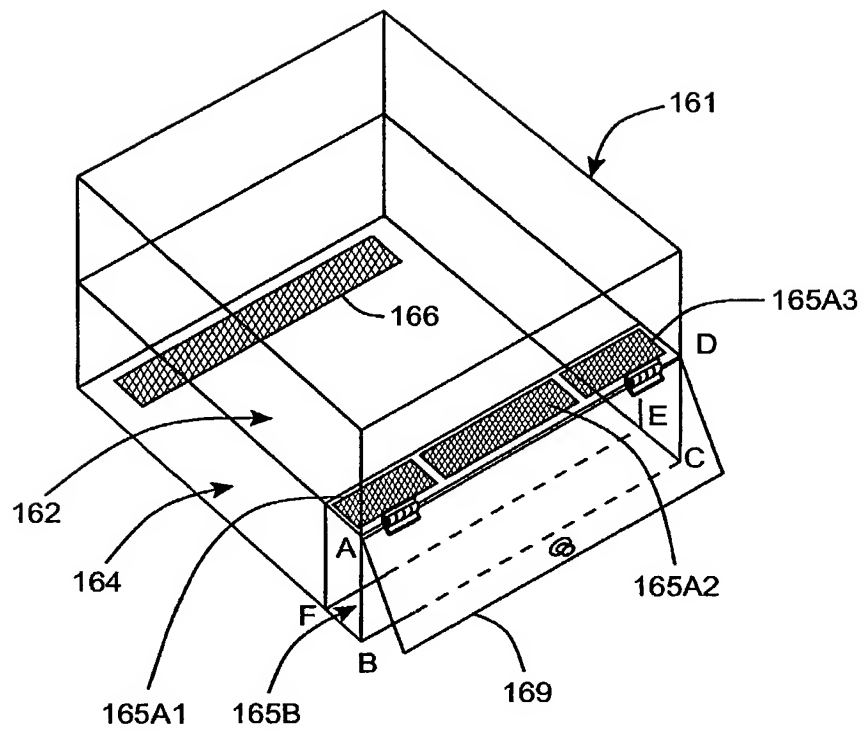


FIG. 12A



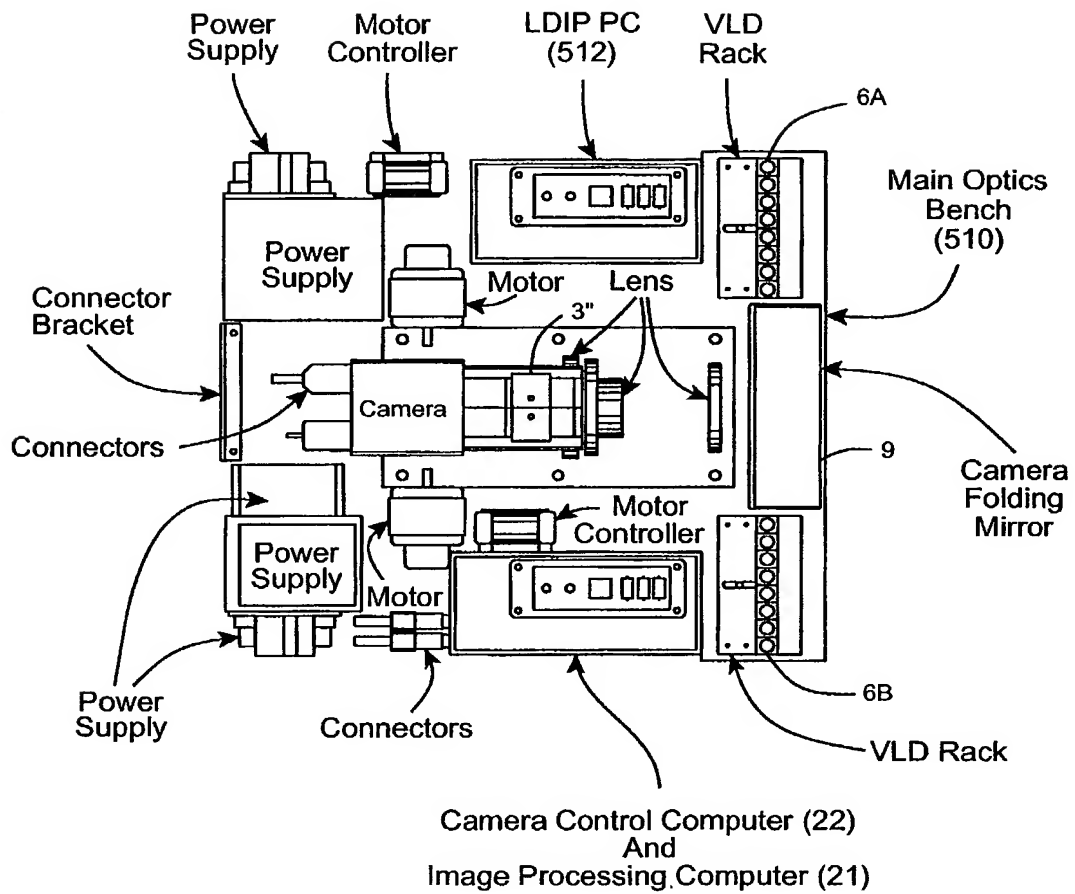


FIG. 12C



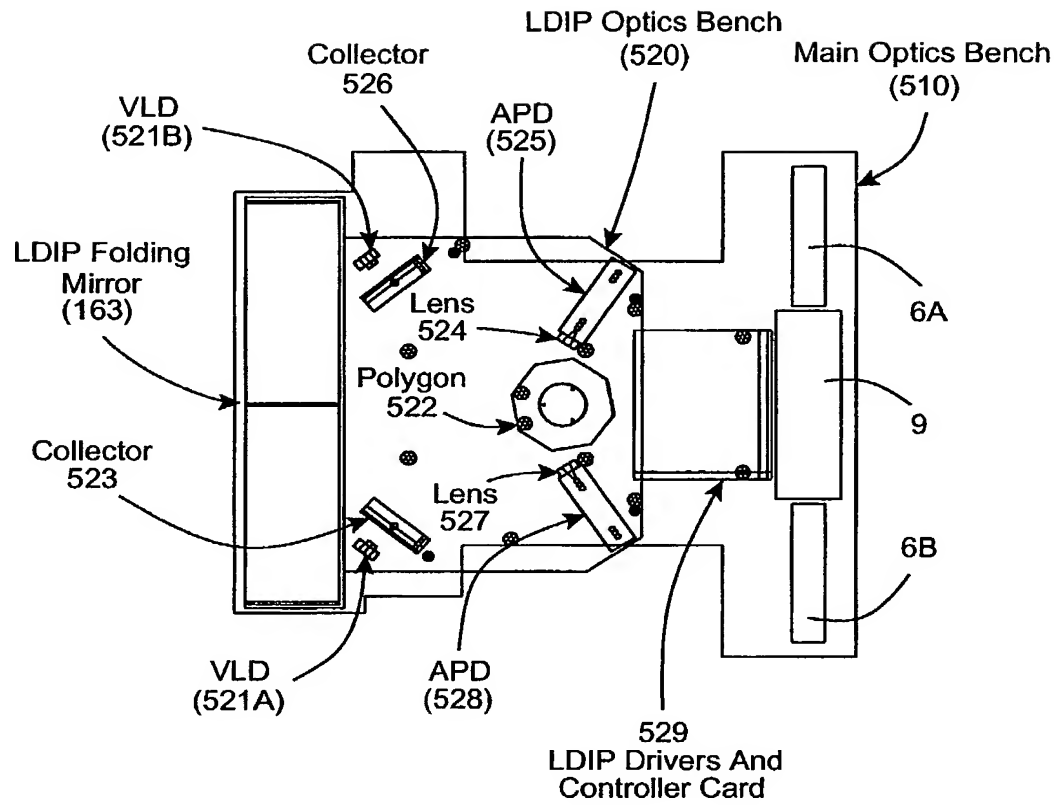
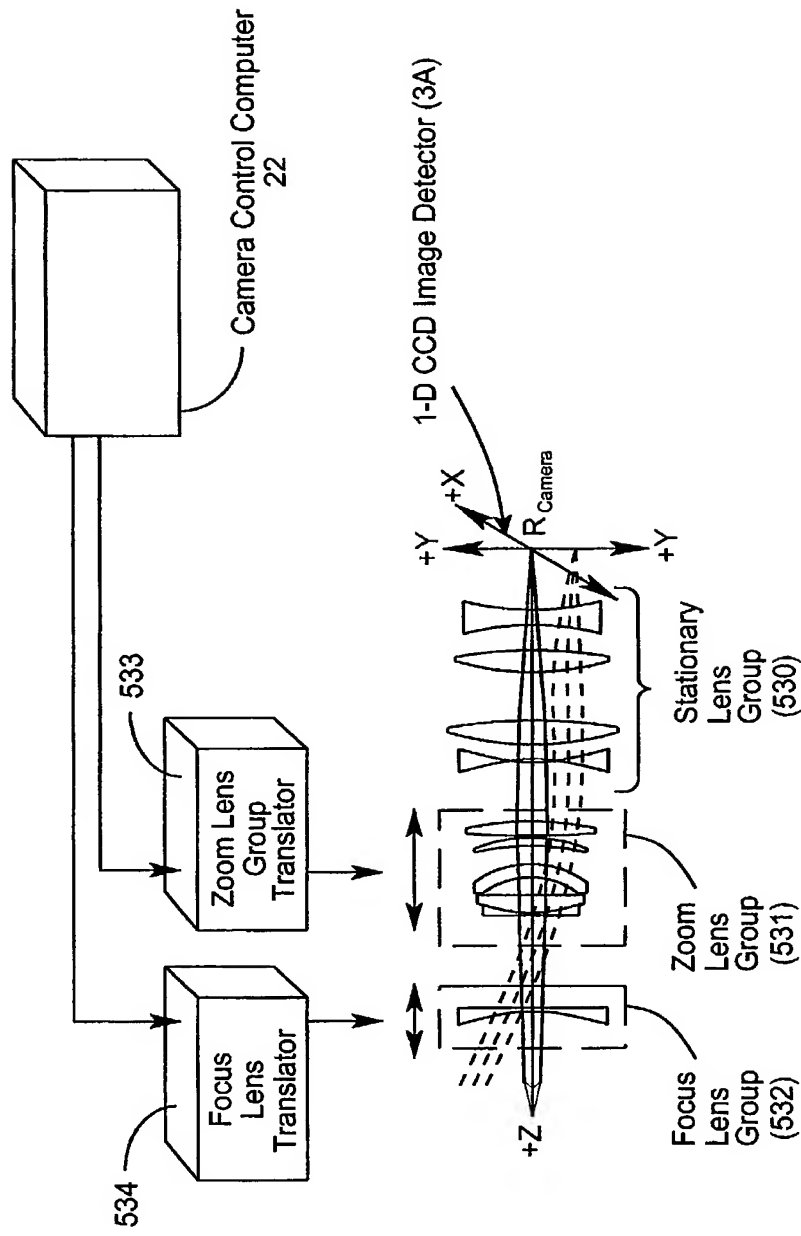


FIG. 12D



Main Optics Lens Groups

FIG. 12E

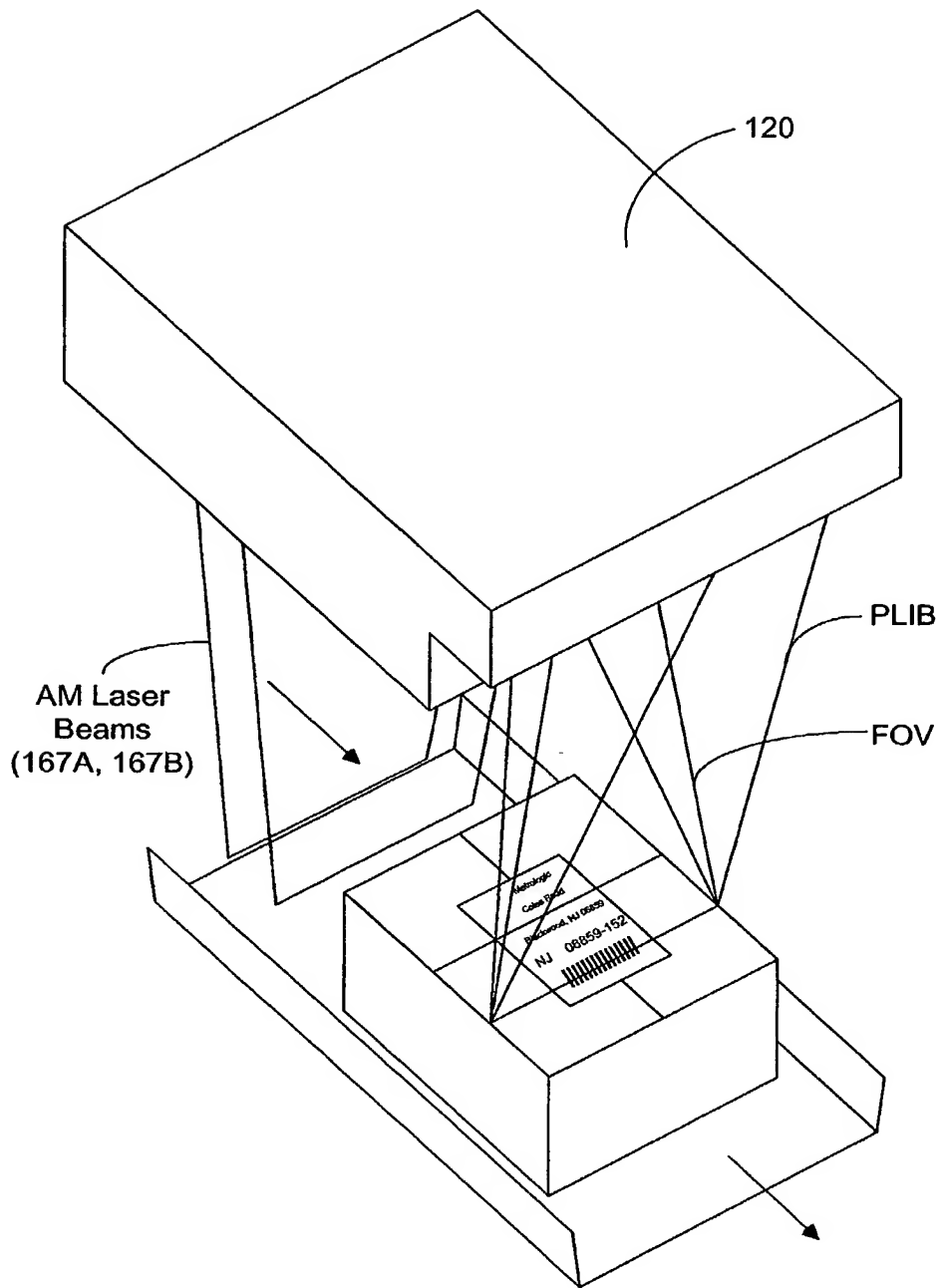


FIG. 13A

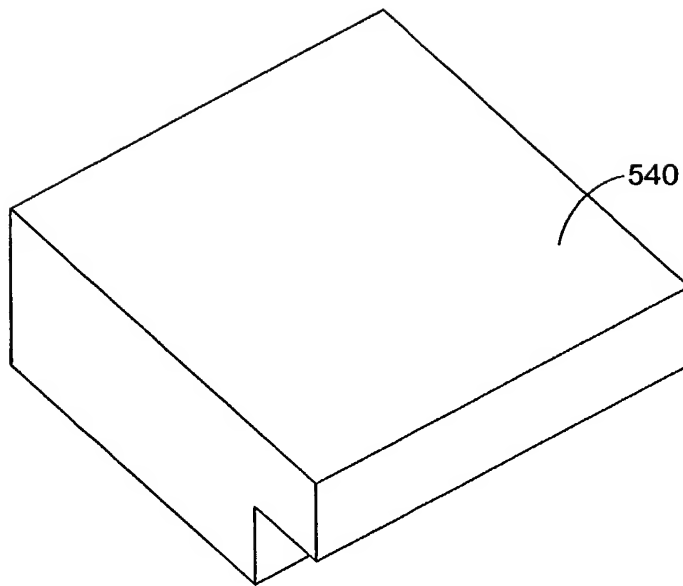


FIG. 13B

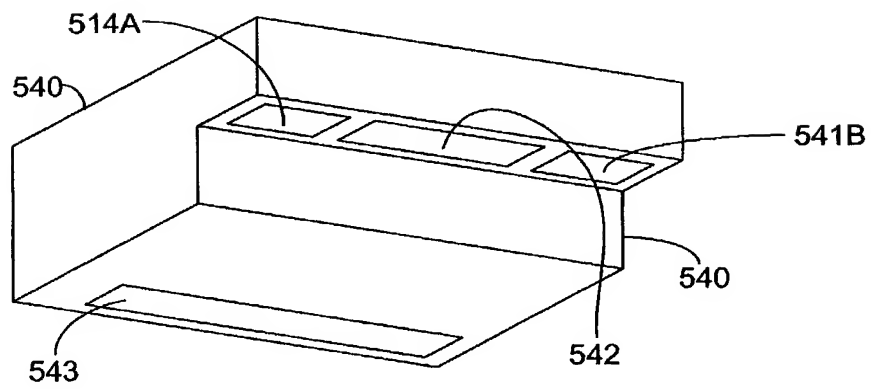


FIG. 13C

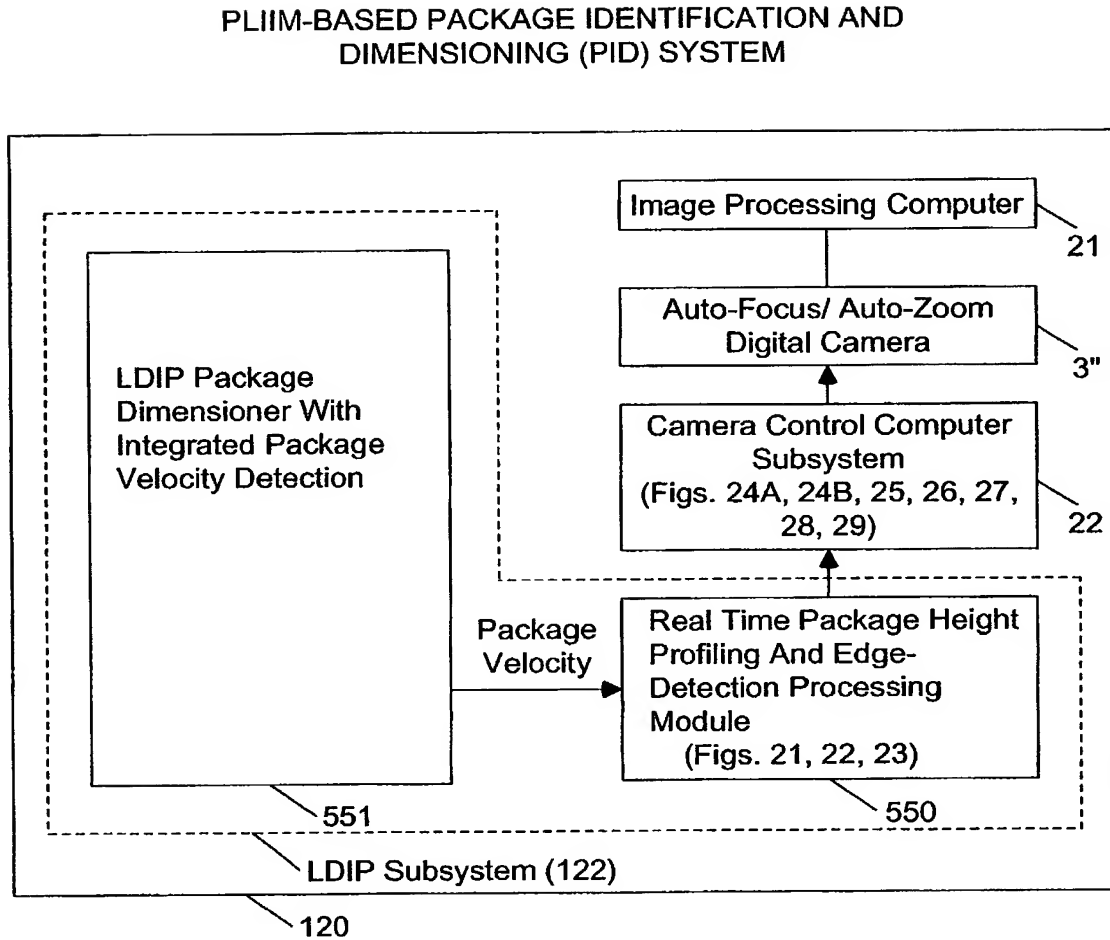


FIG. 14

# LDIP REAL-TIME PACKAGE HEIGHT PROFILE AND EDGE DETECTION METHOD

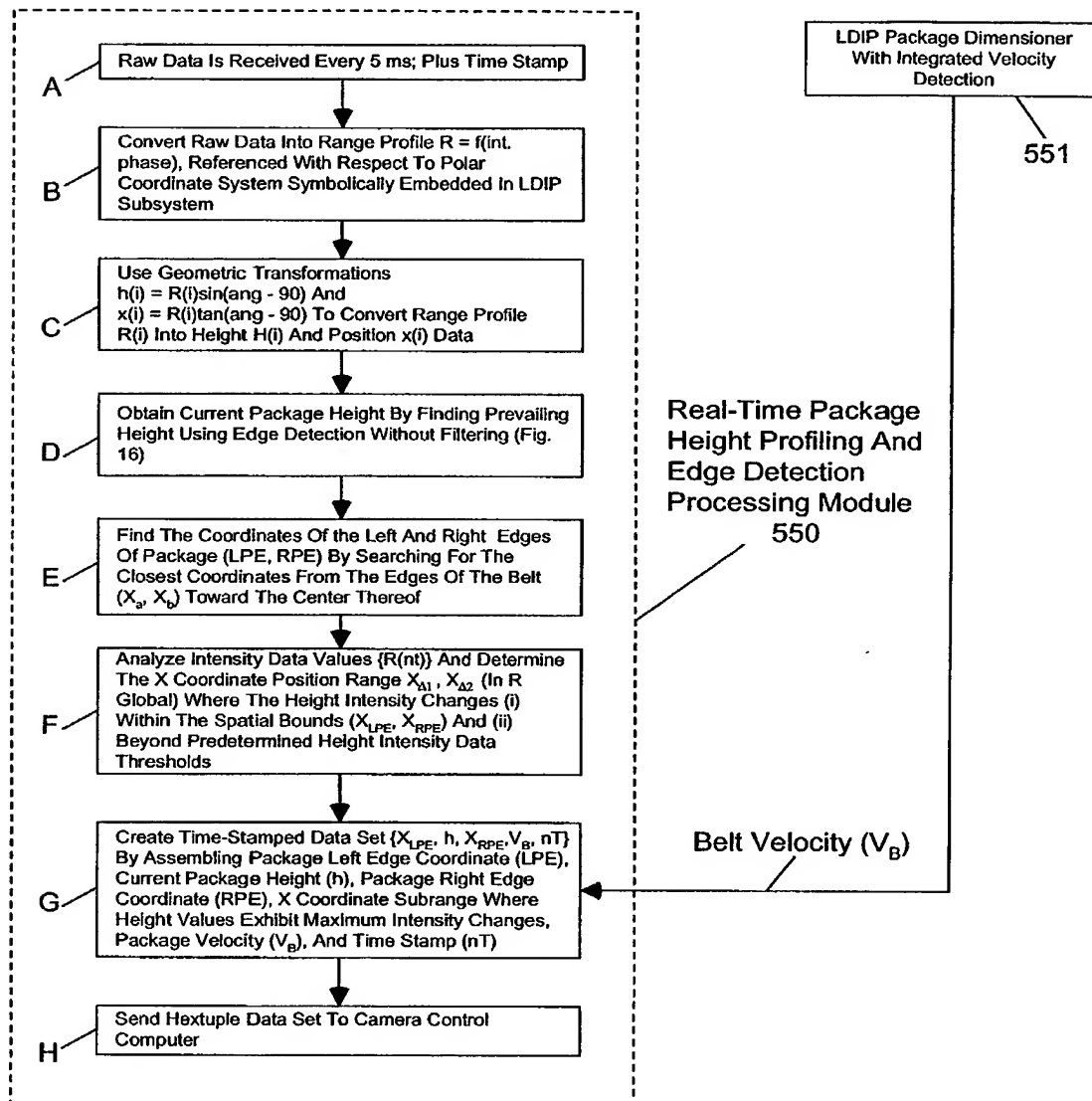


FIG. 15

# LDIP REAL-TIME PACKAGE EDGE DETECTION

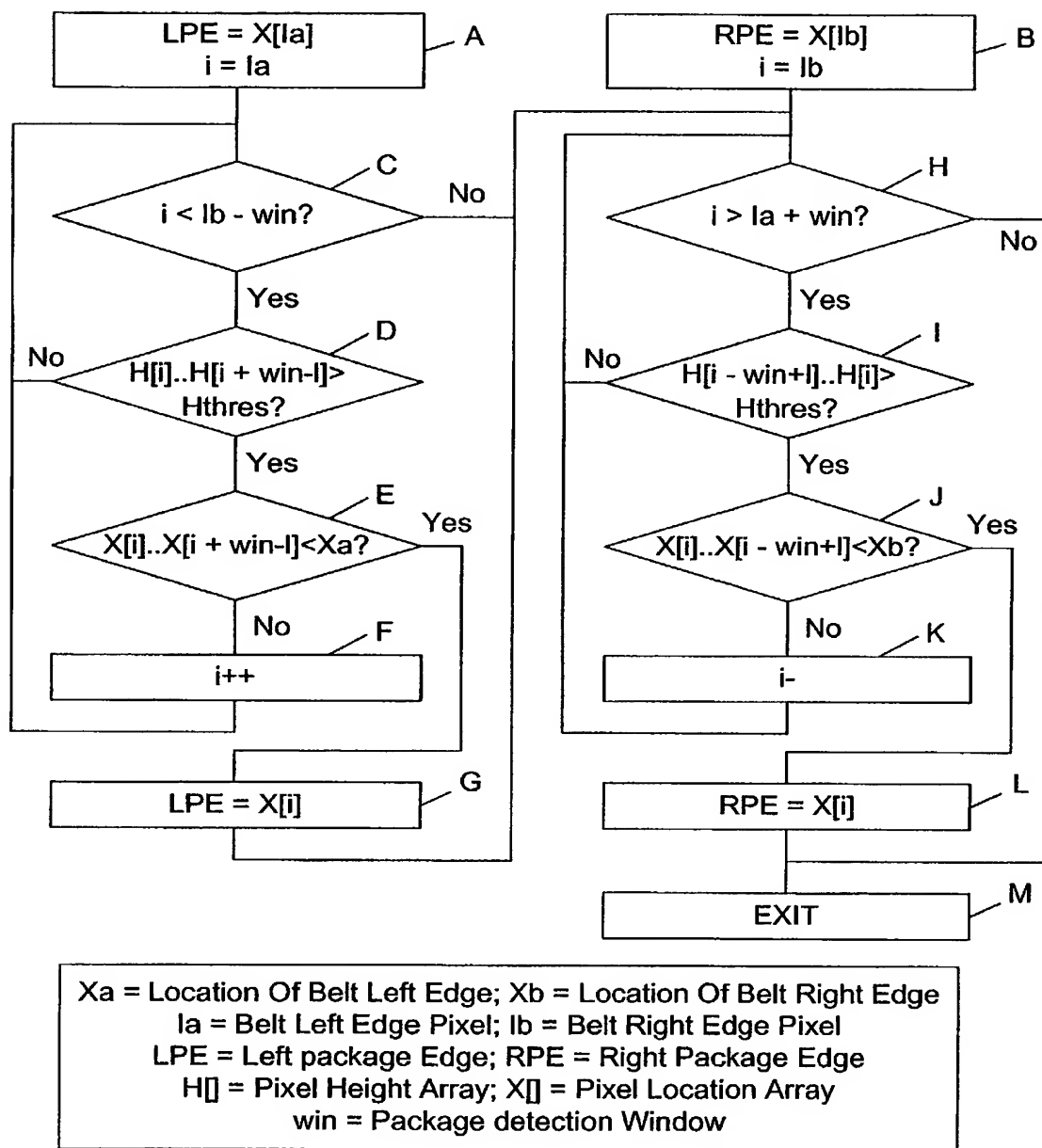


FIG. 16

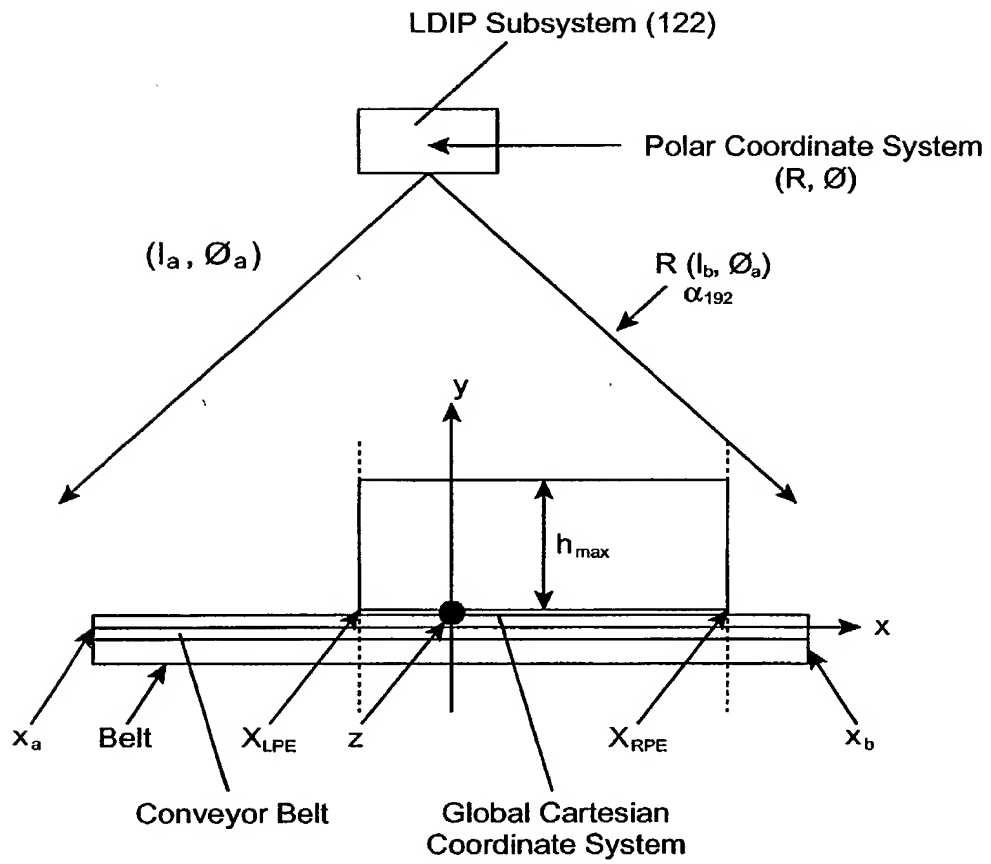


FIG. 17



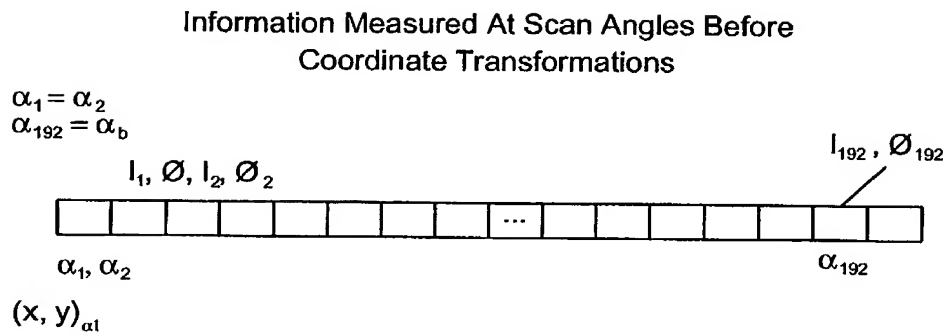


FIG. 17A

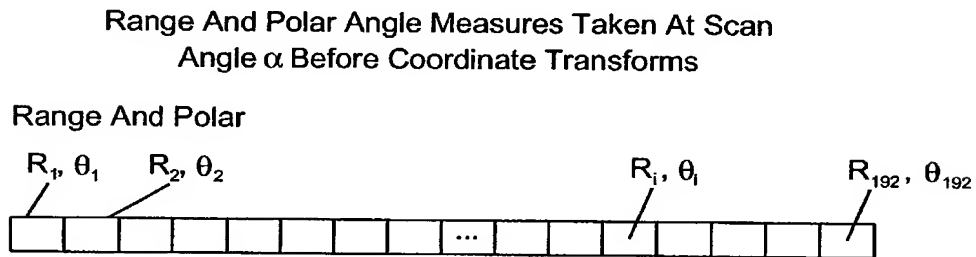


FIG. 17B

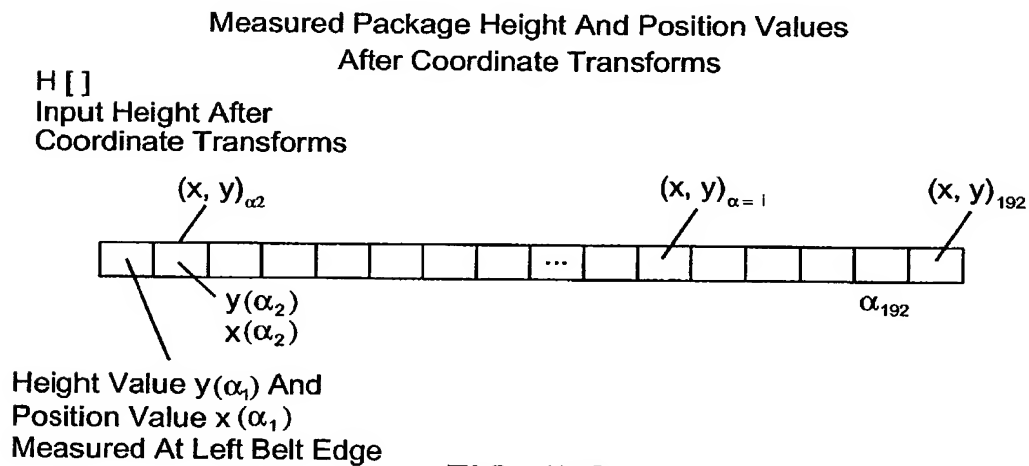
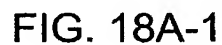


FIG. 17C

$$x_{11} = \frac{1}{2} \begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix}, \quad x_{12} = \frac{1}{2} \begin{pmatrix} 1 & -1 \\ 1 & 1 \end{pmatrix}, \quad x_{13} = \frac{1}{2} \begin{pmatrix} 1 & 1 \\ -1 & 1 \end{pmatrix}, \quad x_{14} = \frac{1}{2} \begin{pmatrix} 1 & -1 \\ -1 & -1 \end{pmatrix}, \quad x_{21} = \frac{1}{2} \begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}, \quad x_{22} = \frac{1}{2} \begin{pmatrix} 1 & -1 \\ 1 & 1 \end{pmatrix}, \quad x_{23} = \frac{1}{2} \begin{pmatrix} 1 & 1 \\ -1 & 1 \end{pmatrix}, \quad x_{24} = \frac{1}{2} \begin{pmatrix} 1 & -1 \\ -1 & -1 \end{pmatrix}, \quad x_{31} = \frac{1}{2} \begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}, \quad x_{32} = \frac{1}{2} \begin{pmatrix} 1 & -1 \\ 1 & 1 \end{pmatrix}, \quad x_{33} = \frac{1}{2} \begin{pmatrix} 1 & 1 \\ -1 & 1 \end{pmatrix}, \quad x_{34} = \frac{1}{2} \begin{pmatrix} 1 & -1 \\ -1 & -1 \end{pmatrix}, \quad x_{41} = \frac{1}{2} \begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}, \quad x_{42} = \frac{1}{2} \begin{pmatrix} 1 & -1 \\ 1 & 1 \end{pmatrix}, \quad x_{43} = \frac{1}{2} \begin{pmatrix} 1 & 1 \\ -1 & 1 \end{pmatrix}, \quad x_{44} = \frac{1}{2} \begin{pmatrix} 1 & -1 \\ -1 & -1 \end{pmatrix}.$$


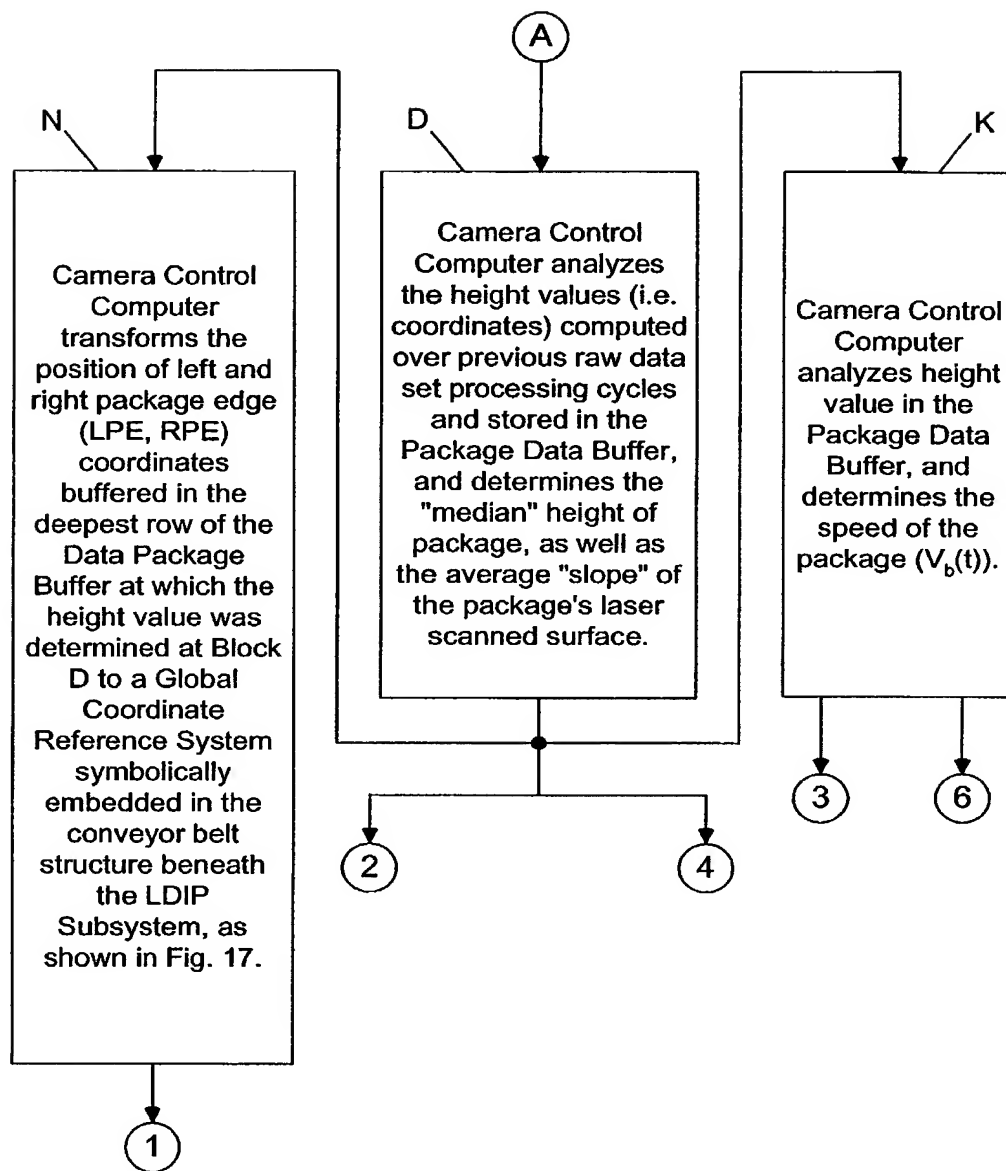


FIG. 18A-2

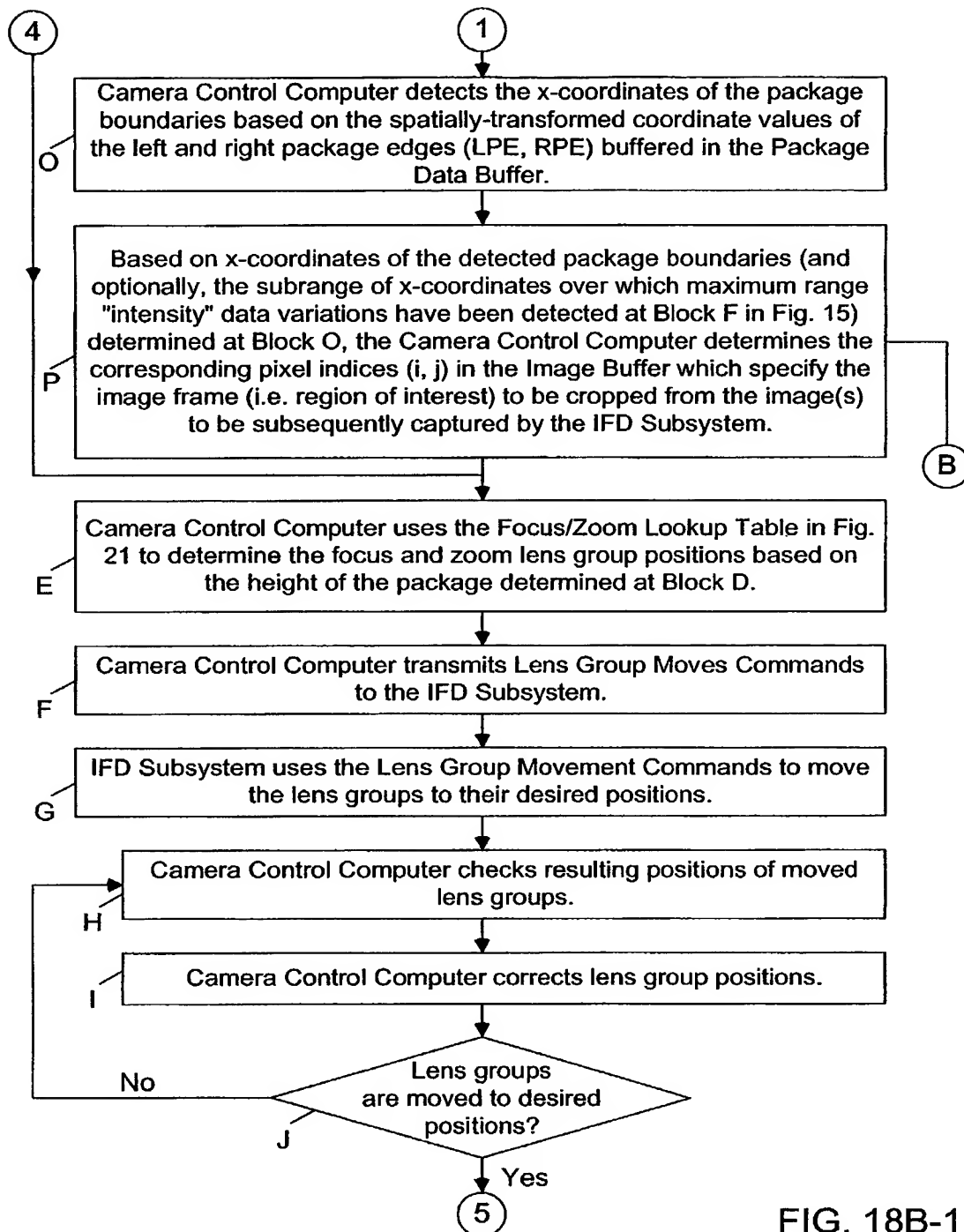
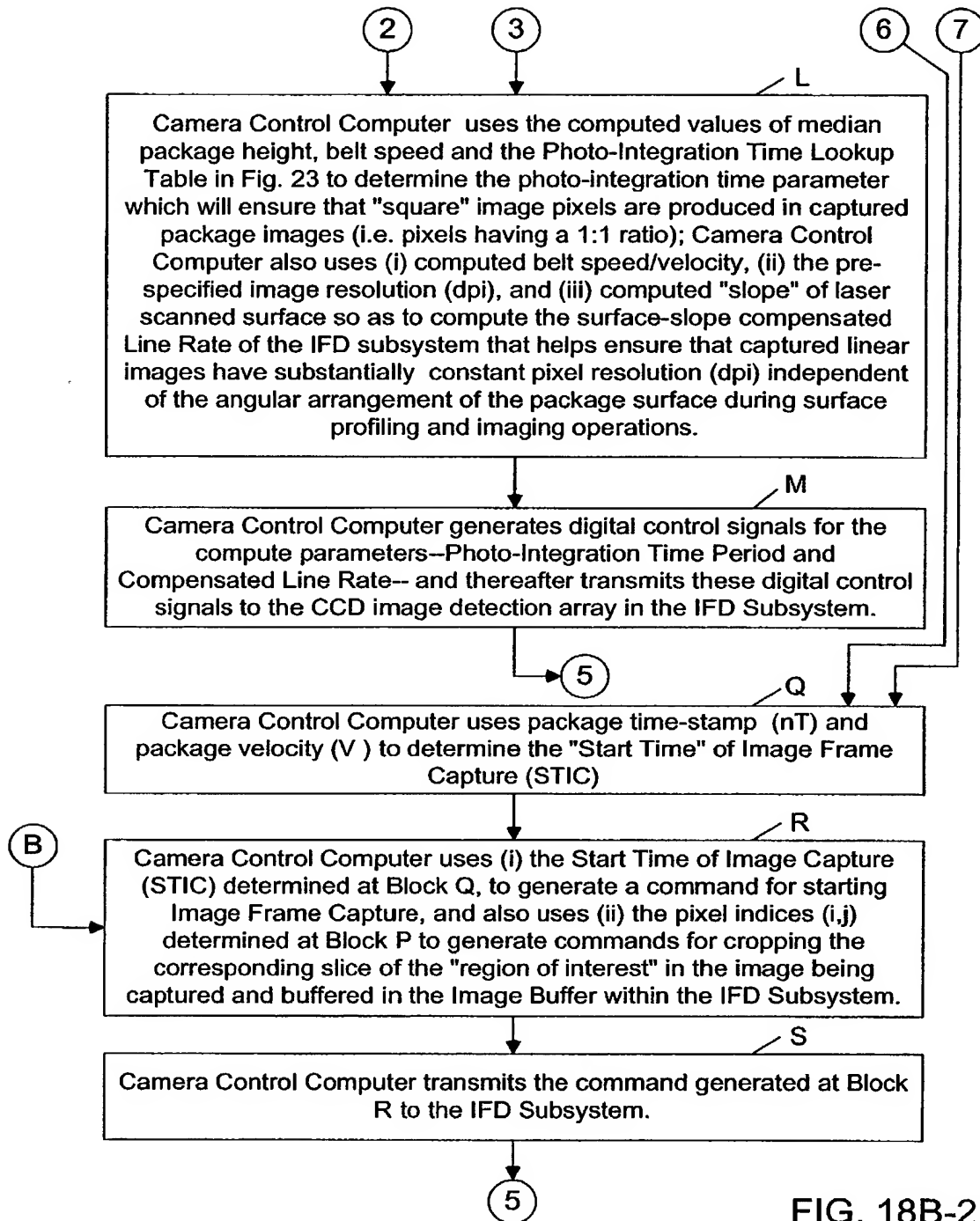


FIG. 18B-1



METHOD OF COMPUTING OPTICAL OUTPUT POWER FROM LASER  
DIODES IN A PLANAR LASER ILLUMINATION ARRAY (PLIA) FOR  
CONTROLLING THE CONSTANT WHITE-LEVEL IN IMAGE PIXELS  
CAPTURED BY A PLIIM-BASED LINEAR IMAGER

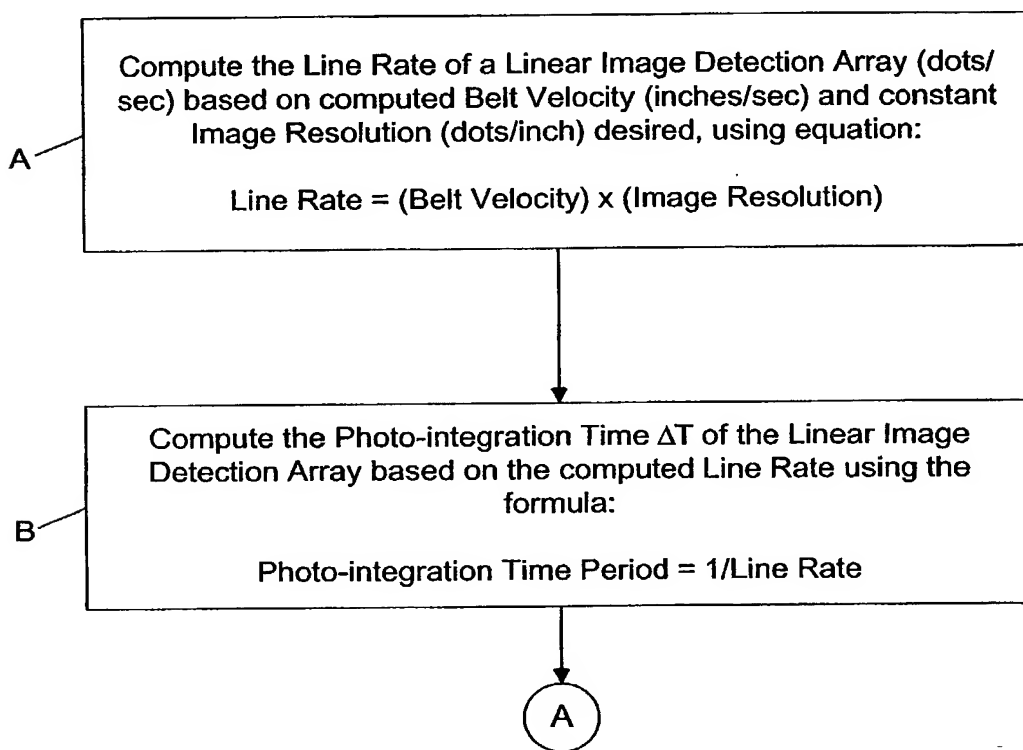


FIG. 18C1

11/517

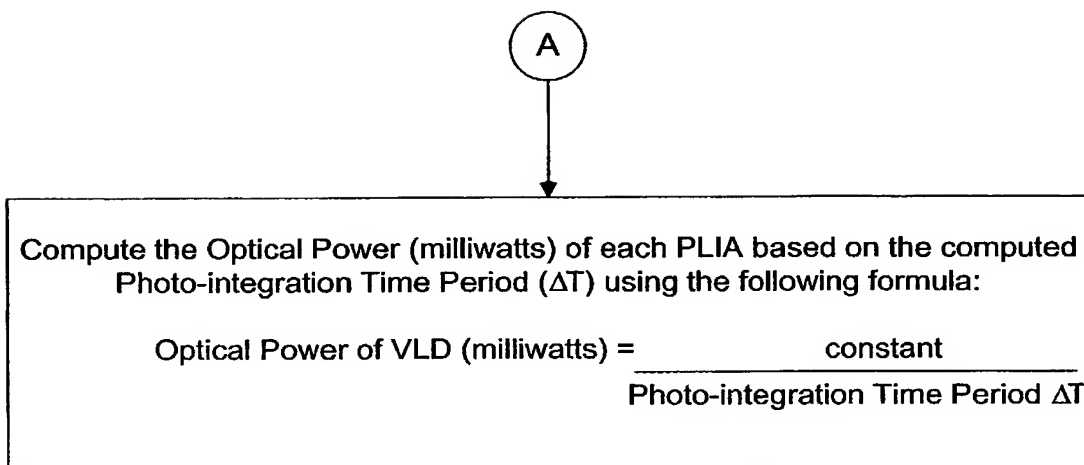


FIG. 18C2

METHOD OF COMPUTING COMPENSATED LINE RATE FOR CORRECTING  
VIEWING-ANGLE DISTORTION OCCURRING IN IMAGES OF OBJECT  
SURFACES CAPTURED AS OBJECT SURFACES MOVE PAST A PLIM-  
BASED LINEAR IMAGER AT NON-ZERO SKEWED ANGLE

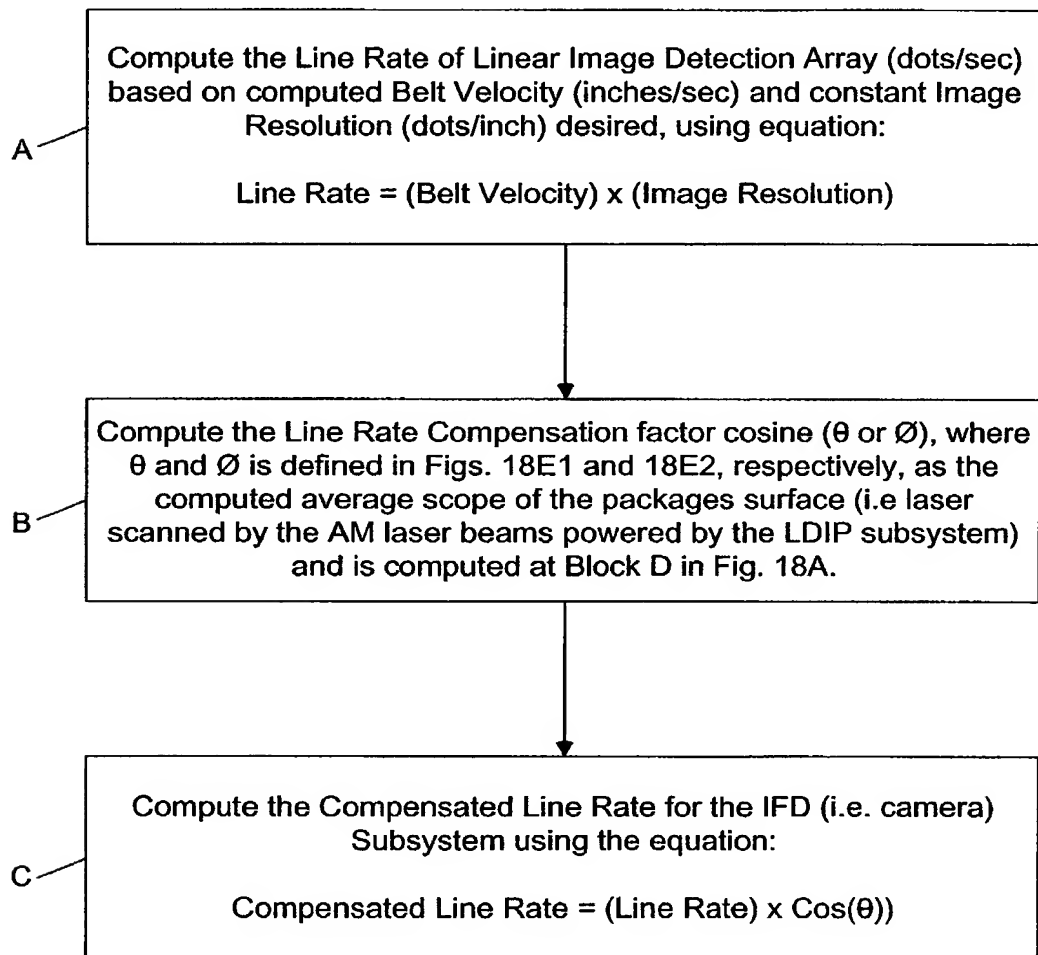
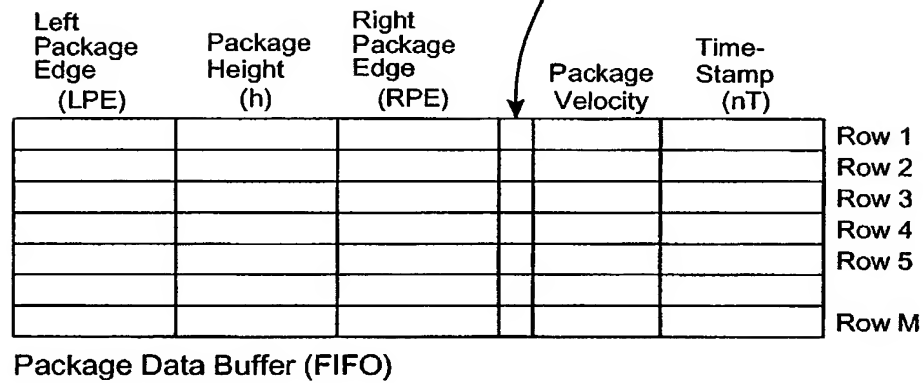


FIG. 18D



### CASE 1: Top Down Imaging



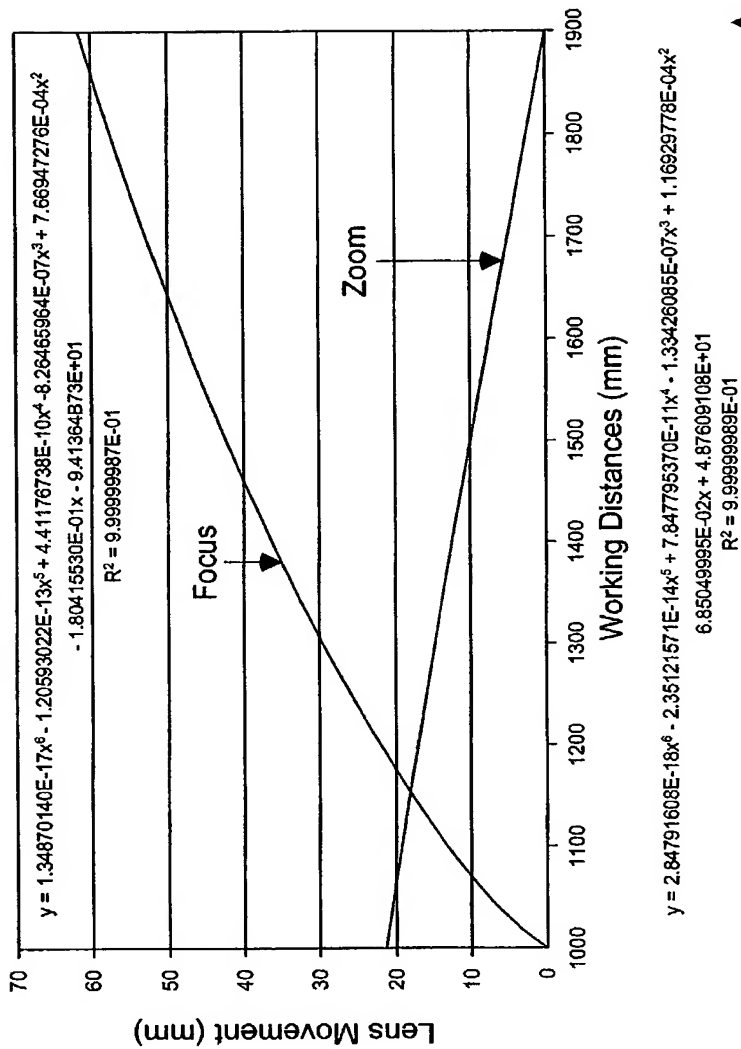
## Look-Up Table

2.47E-05  
10.99009783  
20.65783177  
29.10917002  
36.47312595  
42.87845436  
48.44003358  
53.25495831  
57.40834303  
60.98883615

[illegible]

\* Note: The focal distance and zoom (eff. focal length) of camera lens are coupled (inter-dependant) in this commercial embodiment.

Camera Has A Fixed Aperture F56  
Focus And Zoom Lens Movement vs. Working Distances



← Package Height Above Conveyor  
Conveyor-Belt Surface

FIG. 22A

Photo-Integration Time Look-Up Table

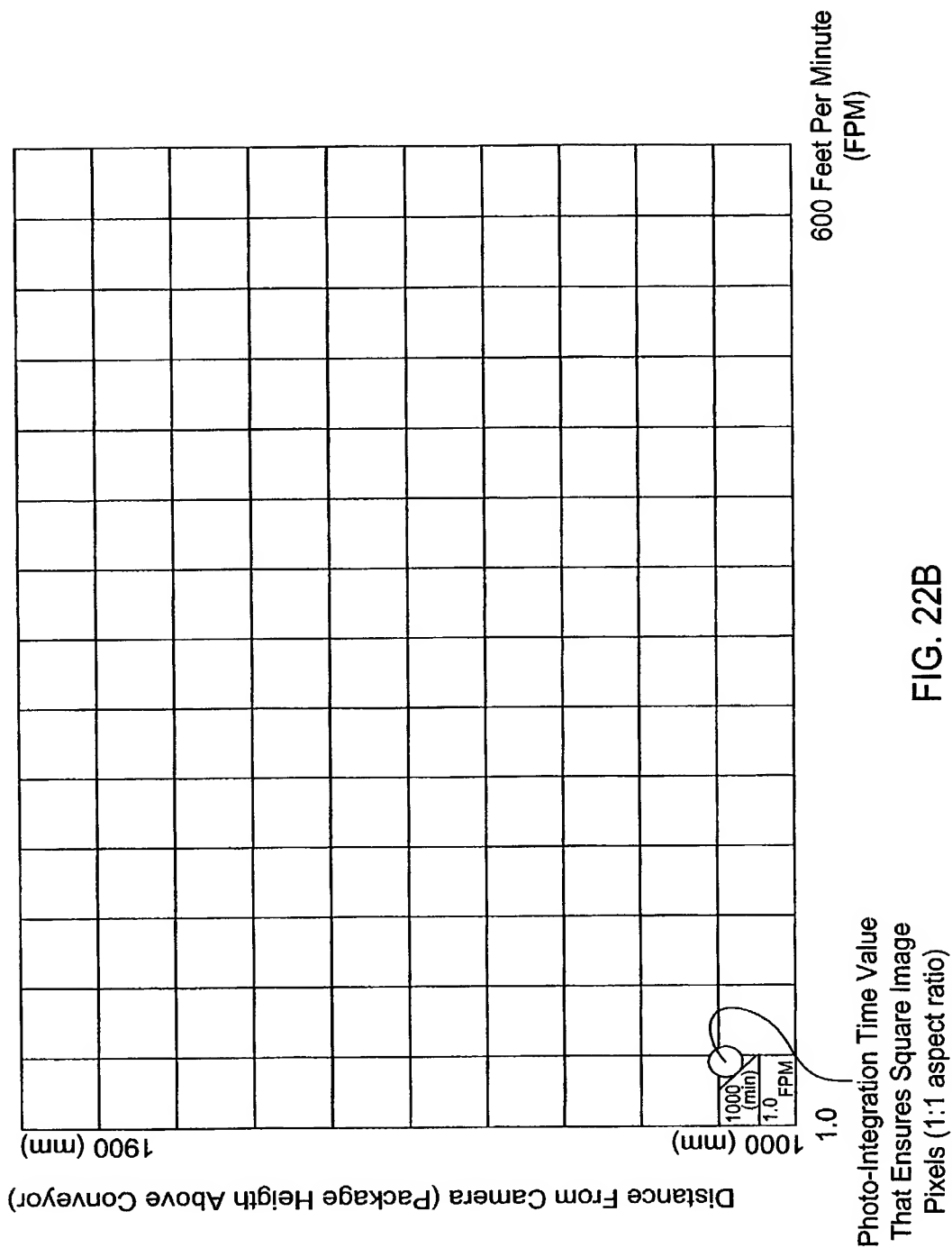


FIG. 22B

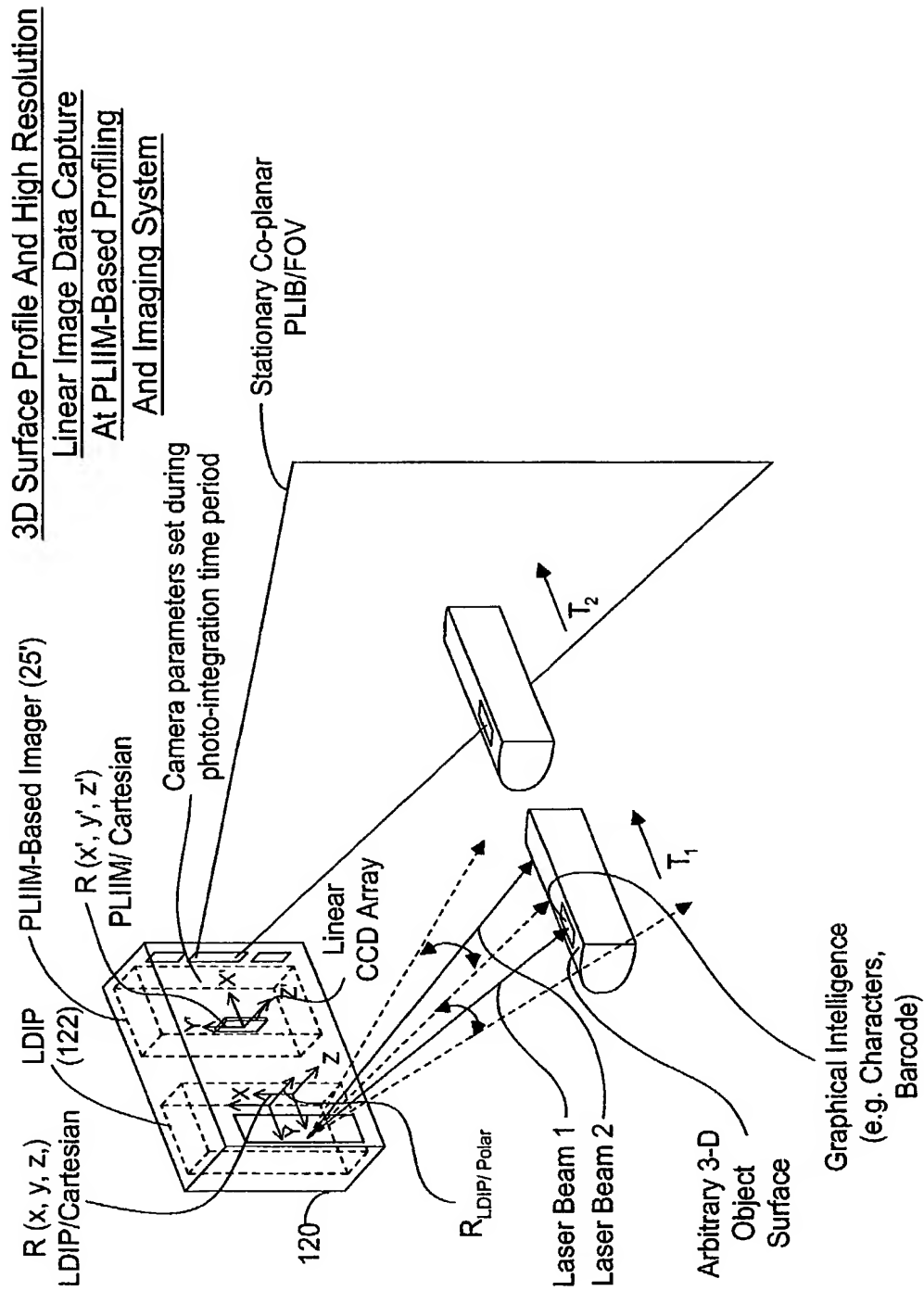


FIG. 23A

100004754, 072547

100/09 T

# Geometrical Modelling Of Arbitrary 3-D Object Surface At Image Processing Computer

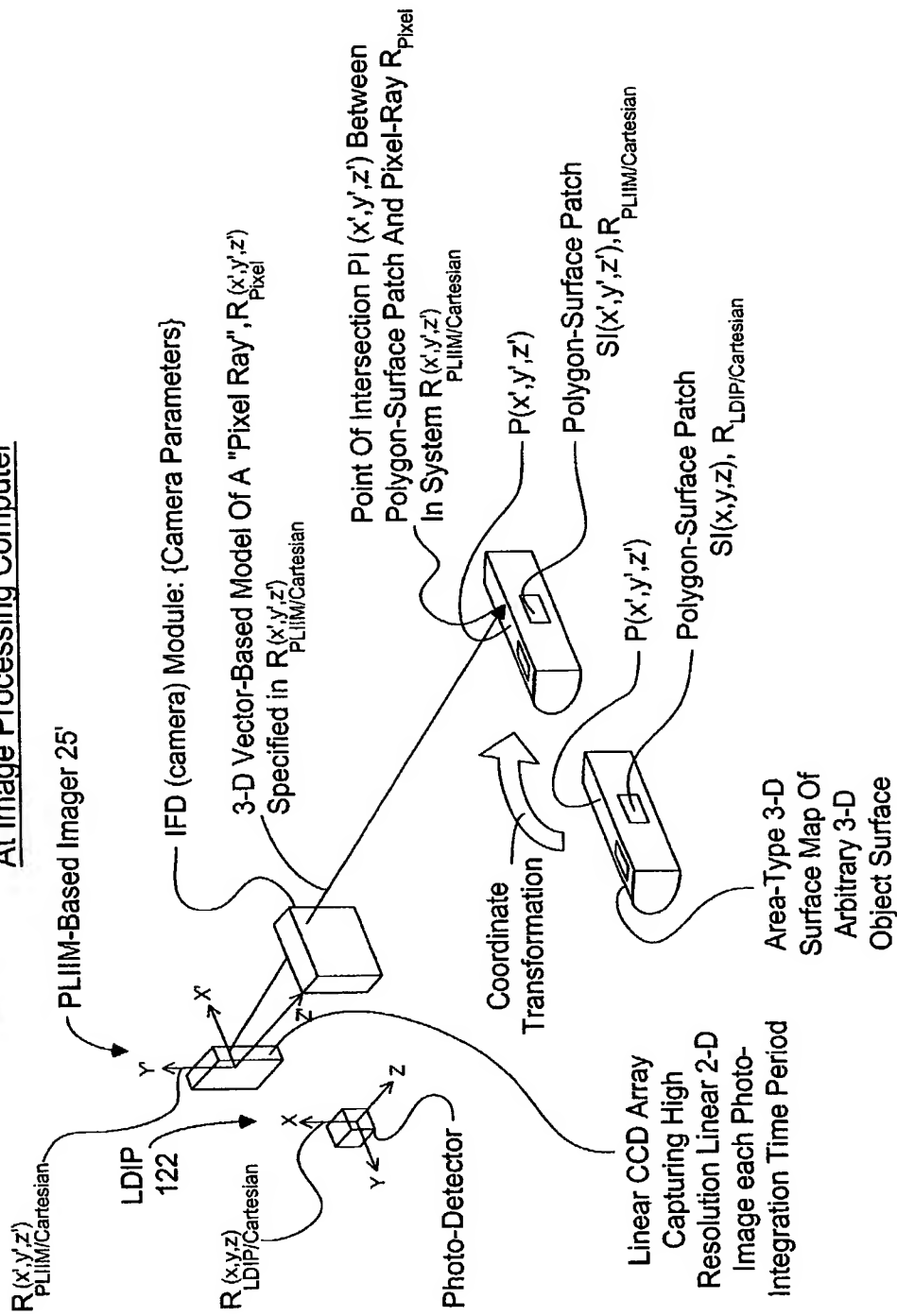


FIG. 23B

METHOD OF AND APPARATUS FOR PERFORMING AUTOMATIC  
RECOGNITION OF GRAPHICAL INTELLIGENCE CONTAINED IN 2-D  
IMAGES CAPTURED FROM ARBITRARY 3-D OBJECT SURFACES

STEP 1: At the unitary PLIIM-based object imaging and profiling system, use the laser doppler imaging and profiling (LDIP) subsystem employed therein to (i) consecutively capture a series of linear 3-D surface profile maps on a targeted arbitrary (e.g. non-planar or planar) 3-D object surface bearing forms of graphical intelligence and (ii) measure the velocity of the arbitrary 3-D object surface, wherein the polar coordinates of each point in the captured linear 3-D surface profile map are specified in a local polar coordinate system  $R_{LDIP/polar}$ , symbolically embedded within the LDIP subsystem.

A

STEP 2: At the unitary PLIIM-based object imaging and profiling system, use coordinate transforms to automatically convert the polar coordinates of each point  $p(\alpha, R)$  in the captured linear 3-D surface profile map into x,y, z Cartesian coordinates specified as  $p(x,y,z)$  in a local Cartesian coordinate system  $R_{LDIP/Cartesian}$ , symbolically embedded within the LDIP subsystem.

B

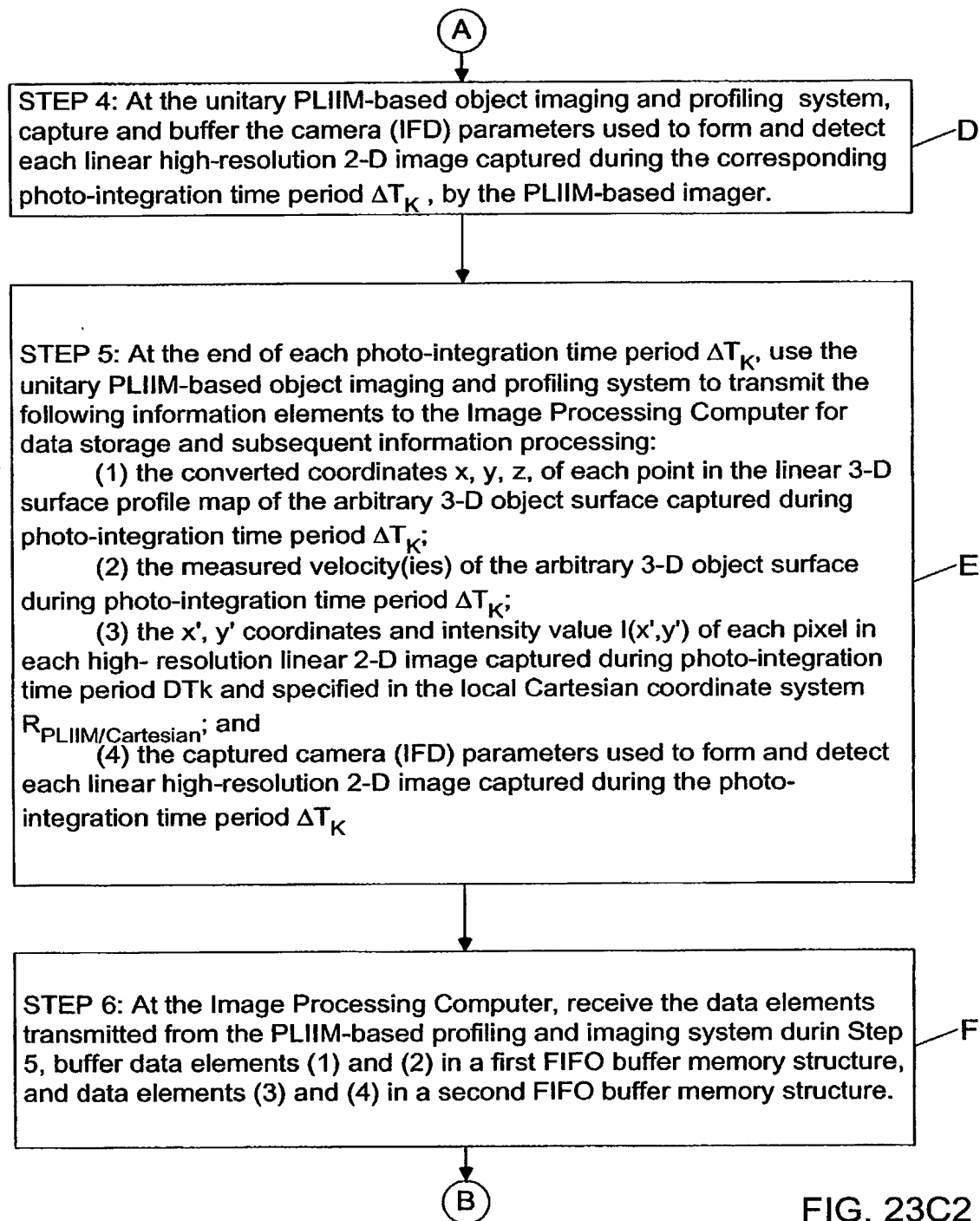
STEP 3: At the unitary PLIIM-based object imaging and profiling system, use the PLIIM-based imager employed therein to consecutively capture high-resolution linear 2-D images of the arbitrary 3-D object surface bearing forms of graphical intelligence (e.g. symbol character strings), wherein (i) the  $x', y'$  coordinates of each pixel in each said captured high-resolution linear 2-D image is specified in local Cartesian coordinate system  $R_{PLIIM/Cartesian}$  symbolically embedded within the PLIIM-based imager, and (ii) the intensity value of the pixel  $I(x',y')$  is associated with the  $x', y'$  Cartesian coordinates of the image detection element in the linear image detection array at which the pixel is detected, and (iii) wherein also the planar laser illumination beam (PLIB) of the PLIIM-based imager is spaced from the amplitude modulated (AM) laser scanning beam of the LDIP subsystem is about D centimeters.

C

A

FIG. 23C1





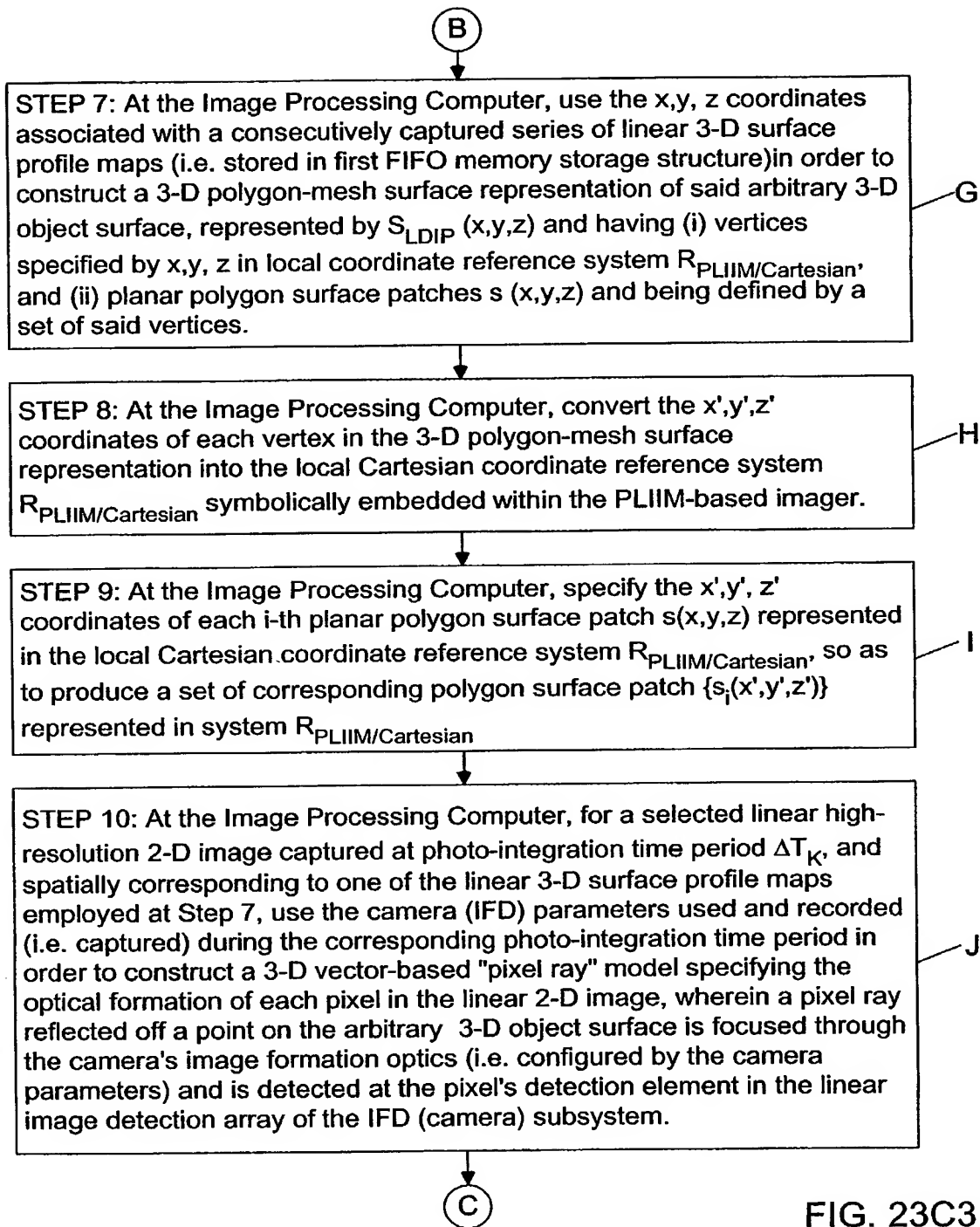
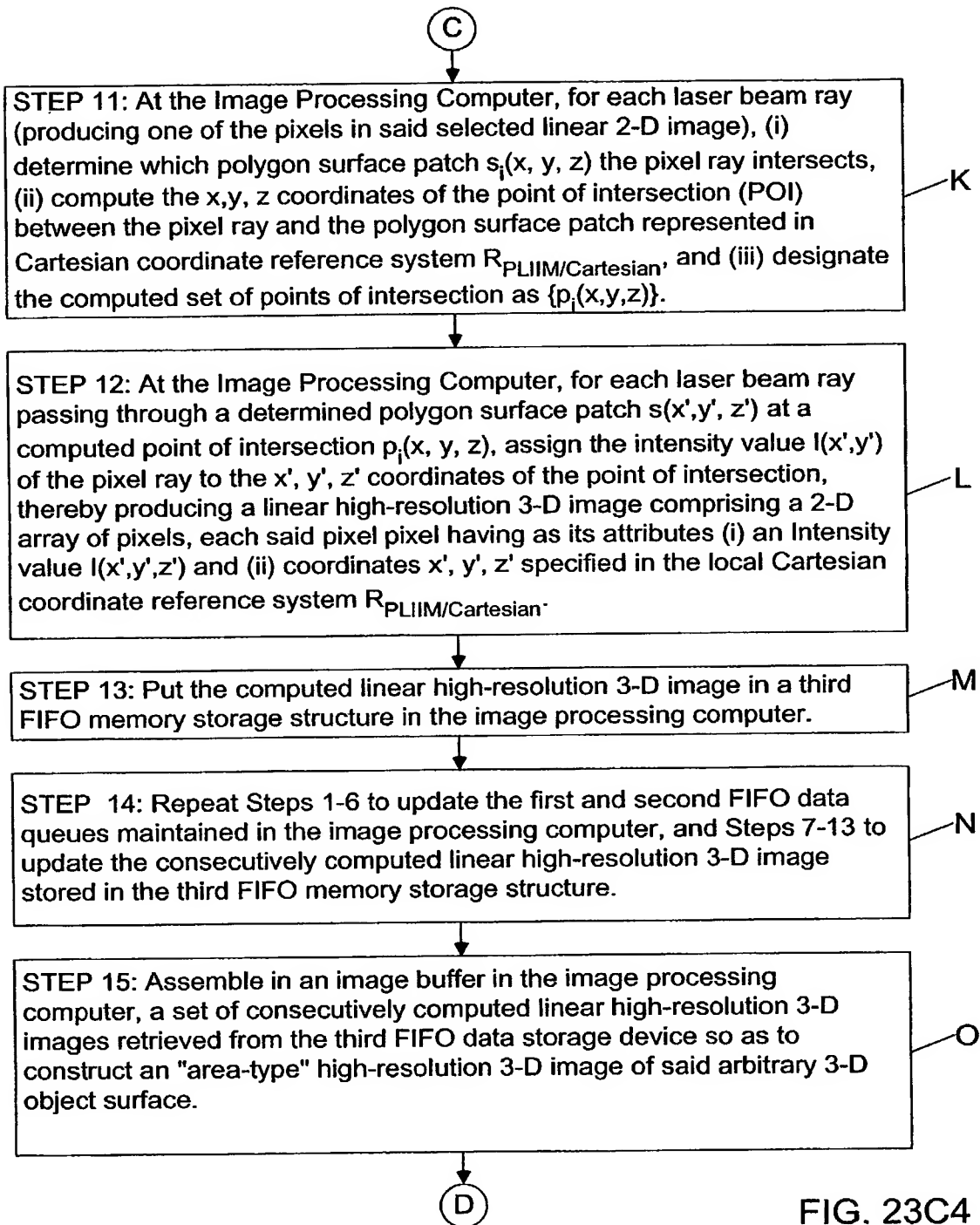


FIG. 23C3

7-11





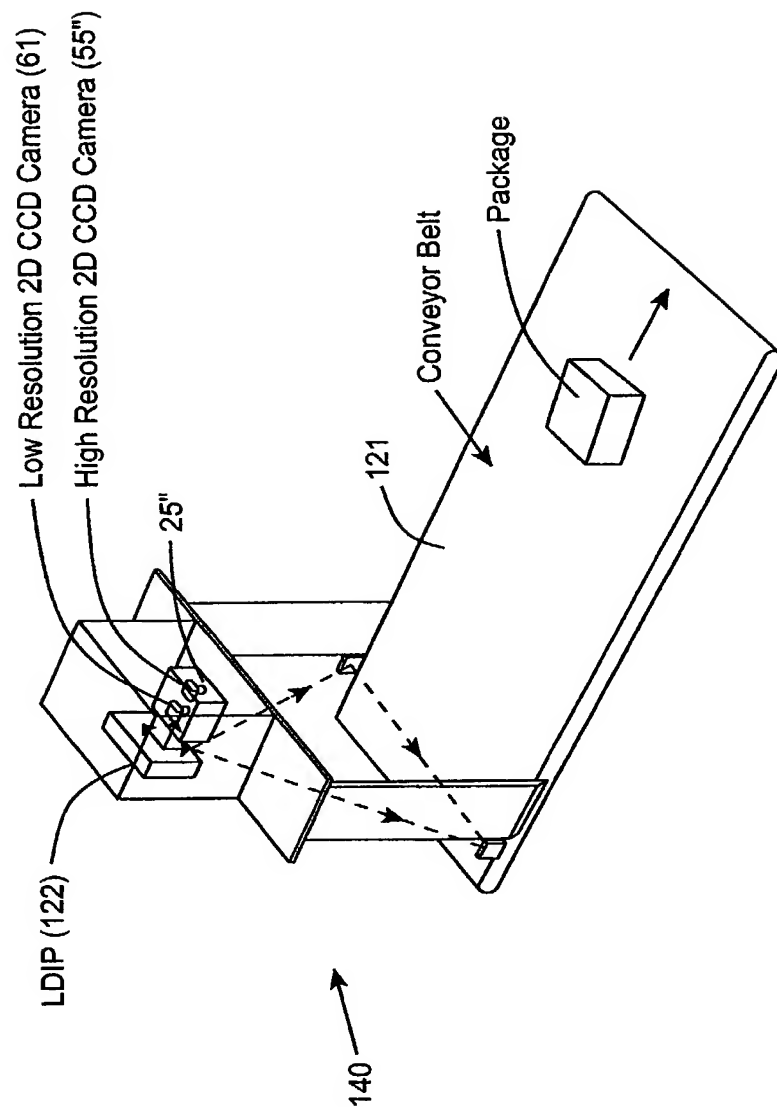


FIG. 24

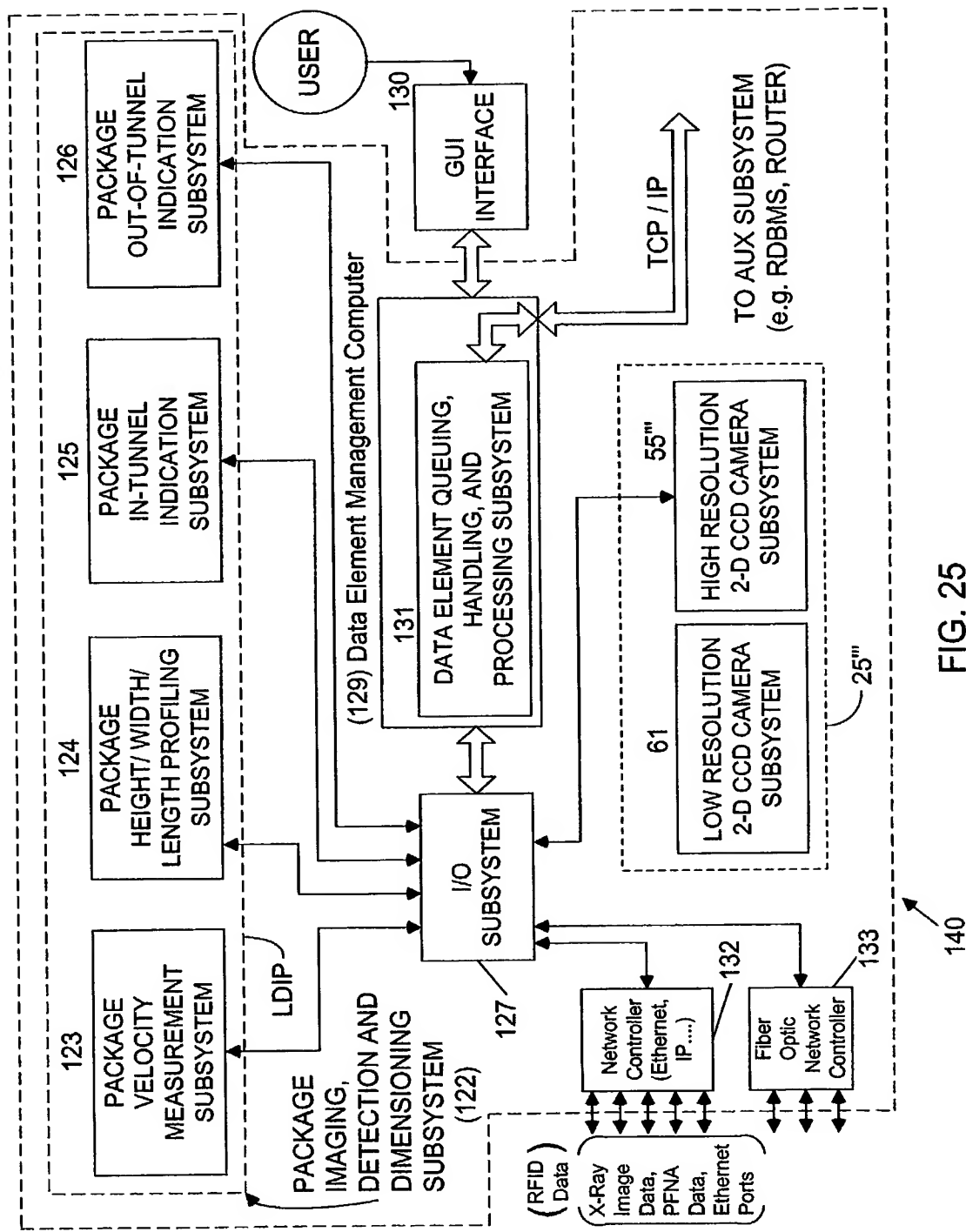


FIG. 25

Data Element Queuing, Handling, and Processing Subsystem (131)

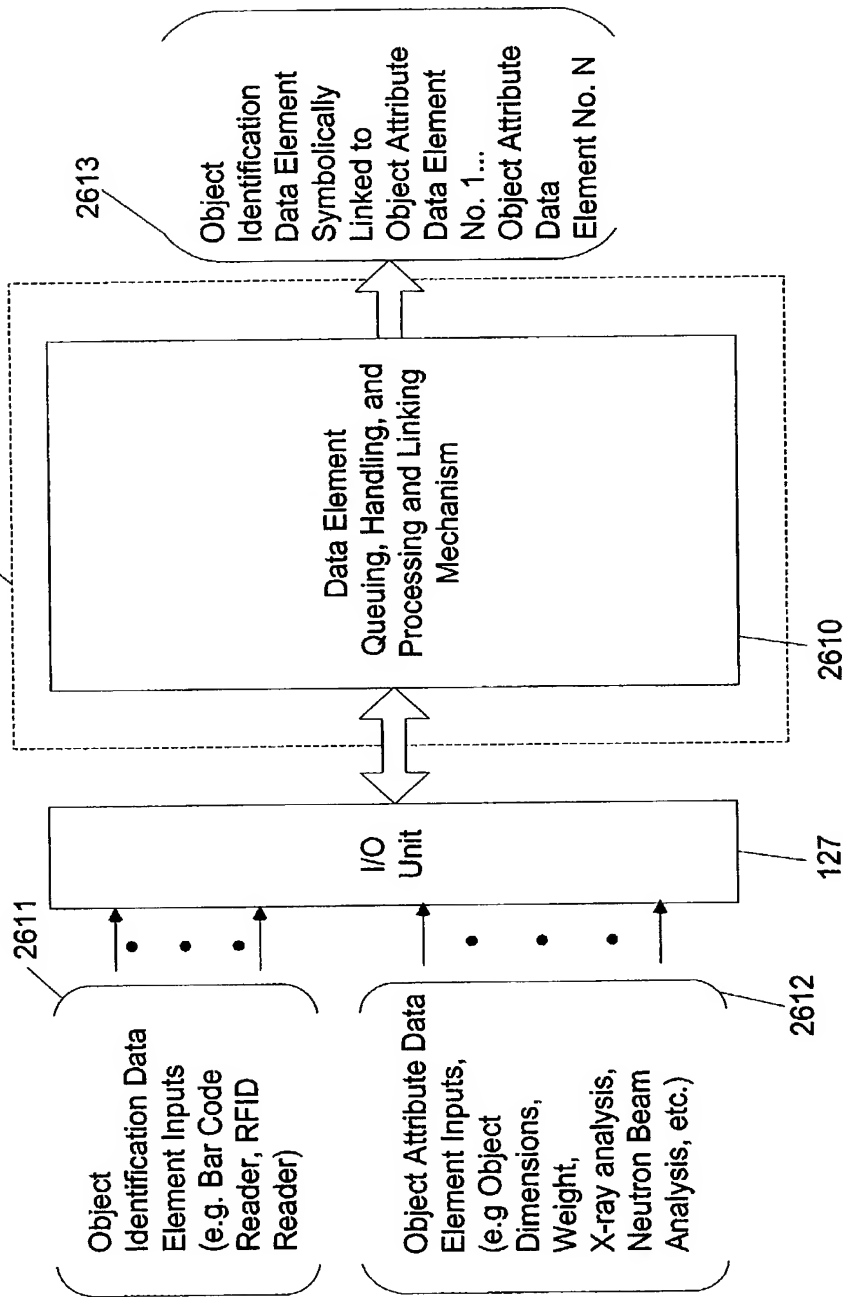


FIG. 25A

**Specification of Object Detection, Tracking, and Identification and Attribute-Acquisition Capabilities of a Configured System or Network.**

- 
- ```
graph TD; A((Detection and Tracking of Singulated Objects)) --> B((Identification of Object Using "Flying" Spot Laser Scanning Beam Techniques)); A --> C((Identification of Object Using RFID Techniques)); B --> D((Acquisition of Object Dimensions Only)); B --> E((Acquisition of Object Dimensions and Other Object Attributes)); C --> F((Acquisition of Object Dimensions Only)); C --> G((Acquisition of Object Dimensions and Other Object Attributes)); D --> H((5)); E --> I((6)); F --> J((3)); G --> K((4));
```
- The diagram illustrates the classification of object detection and tracking techniques. The root node is "Detection and Tracking of Singulated Objects". It branches into two main categories: "Identification of Object Using 'Flying' Spot Laser Scanning Beam Techniques" and "Identification of Object Using RFID Techniques". The first category further branches into "Acquisition of Object Dimensions Only" (labeled 1) and "Acquisition of Object Dimensions and Other Object Attributes" (labeled 2). The second category branches into "Acquisition of Object Dimensions Only" (labeled 3) and "Acquisition of Object Dimensions and Other Object Attributes" (labeled 4). The "Acquisition of Object Dimensions Only" nodes are further labeled 5 and 6 respectively.

**FIG. 25B-1**



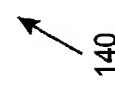
**Specification of Object Detection, Tracking, and Identification and Attribute-Acquisition Capabilities of a Configured System or Network.**

- 
- ```

graph TD
    Root((Detection and Tracking of Non-Singulated Objects))
    Root --- Node1((Identification of Object Using "Flying" Spot Laser Scanning Beam Techniques))
    Root --- Node2((Identification of Object Using RFID Techniques))
    Root --- Node3((Identification of Object Using "Flying" Spot Laser Scanning Beam Techniques))
    Node1 --- Node1_1((Acquisition of Object Dimensions and Other Object Attributes))
    Node1 --- Node1_2((Acquisition of Object Dimensions Only))
    Node2 --- Node2_1((Acquisition of Object Dimensions and Other Object Attributes))
    Node2 --- Node2_2((Acquisition of Object Dimensions Only))
    Node3 --- Node3_1((Acquisition of Object Dimensions and Other Object Attributes))
    Node3 --- Node3_2((Acquisition of Object Dimensions Only))
    
```
- 7 8 9 10 11 12

**FIG. 25B-2**





**FIG. 26**

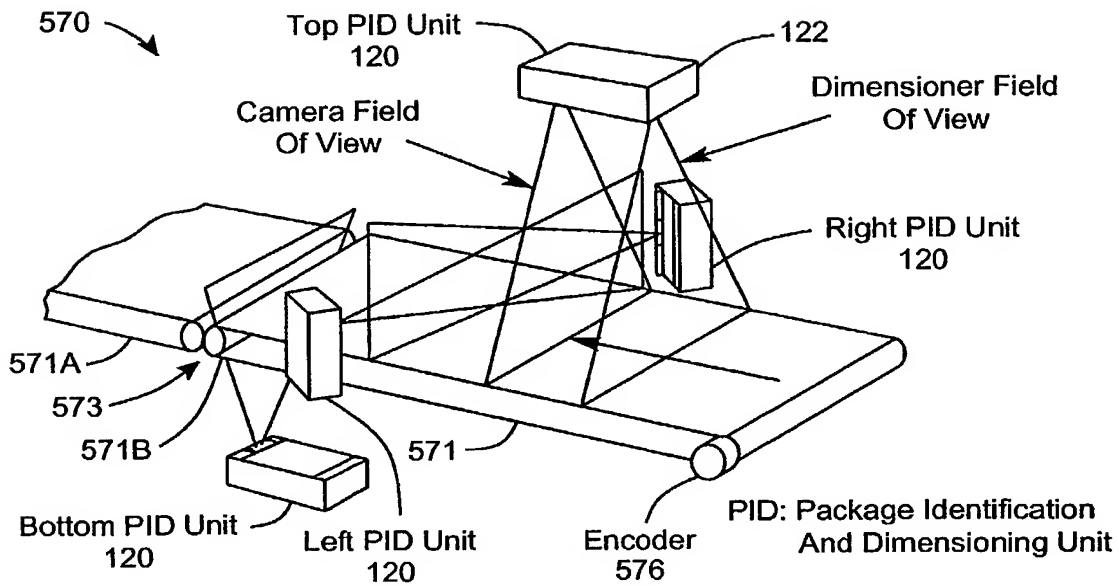


FIG. 27

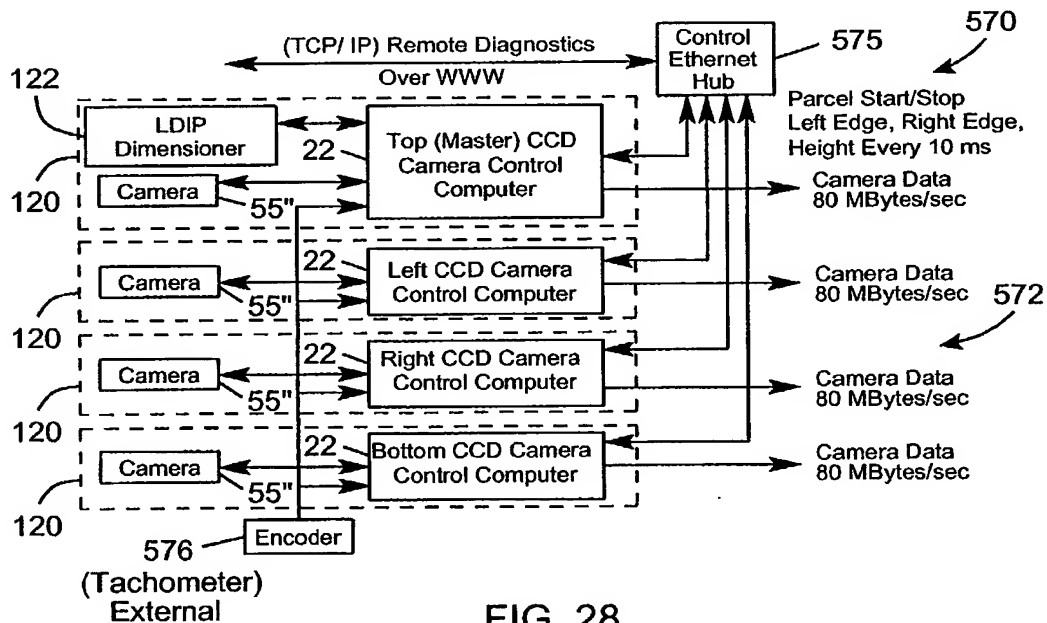


FIG. 28

FIG. 29

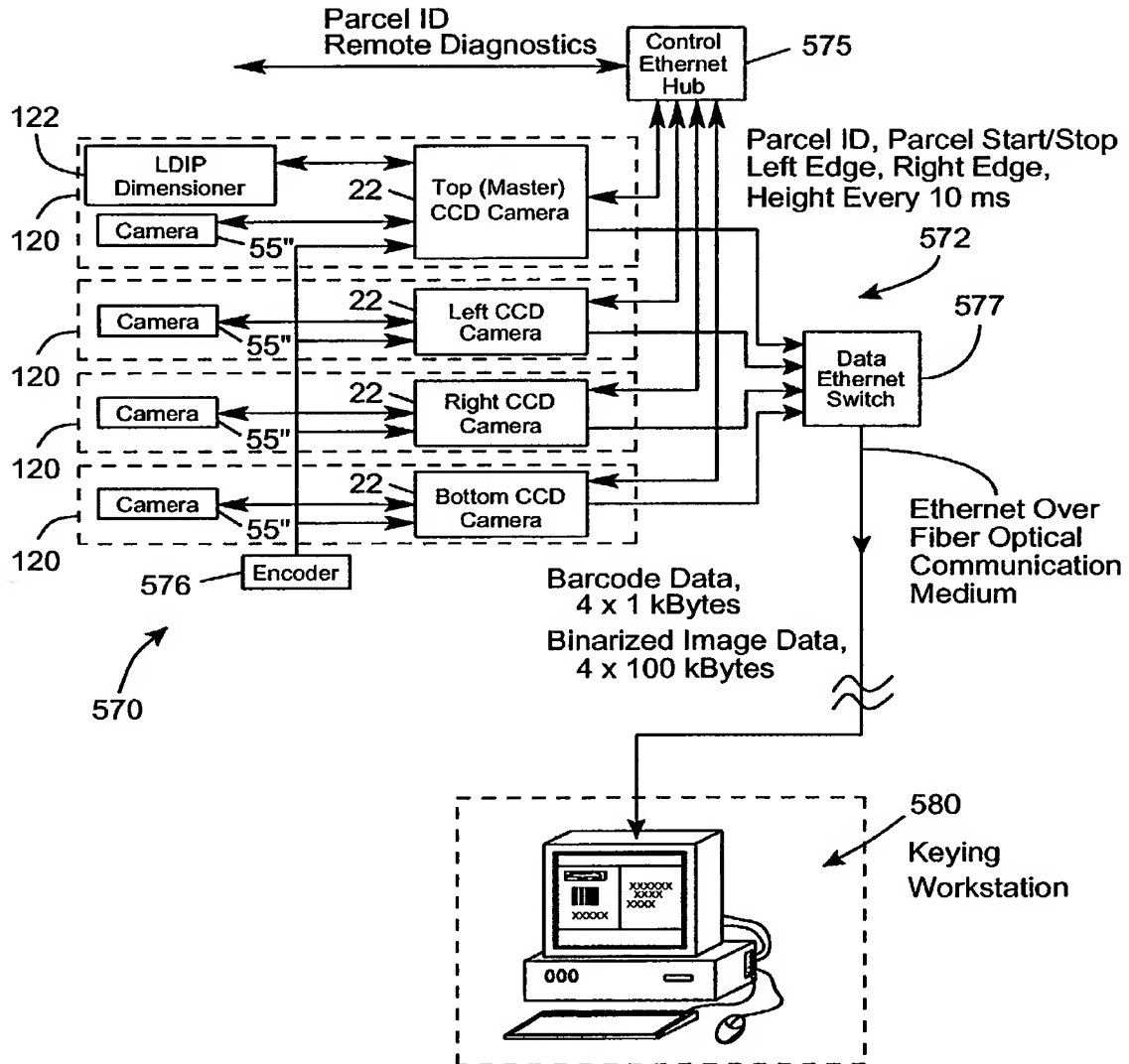


FIG. 29

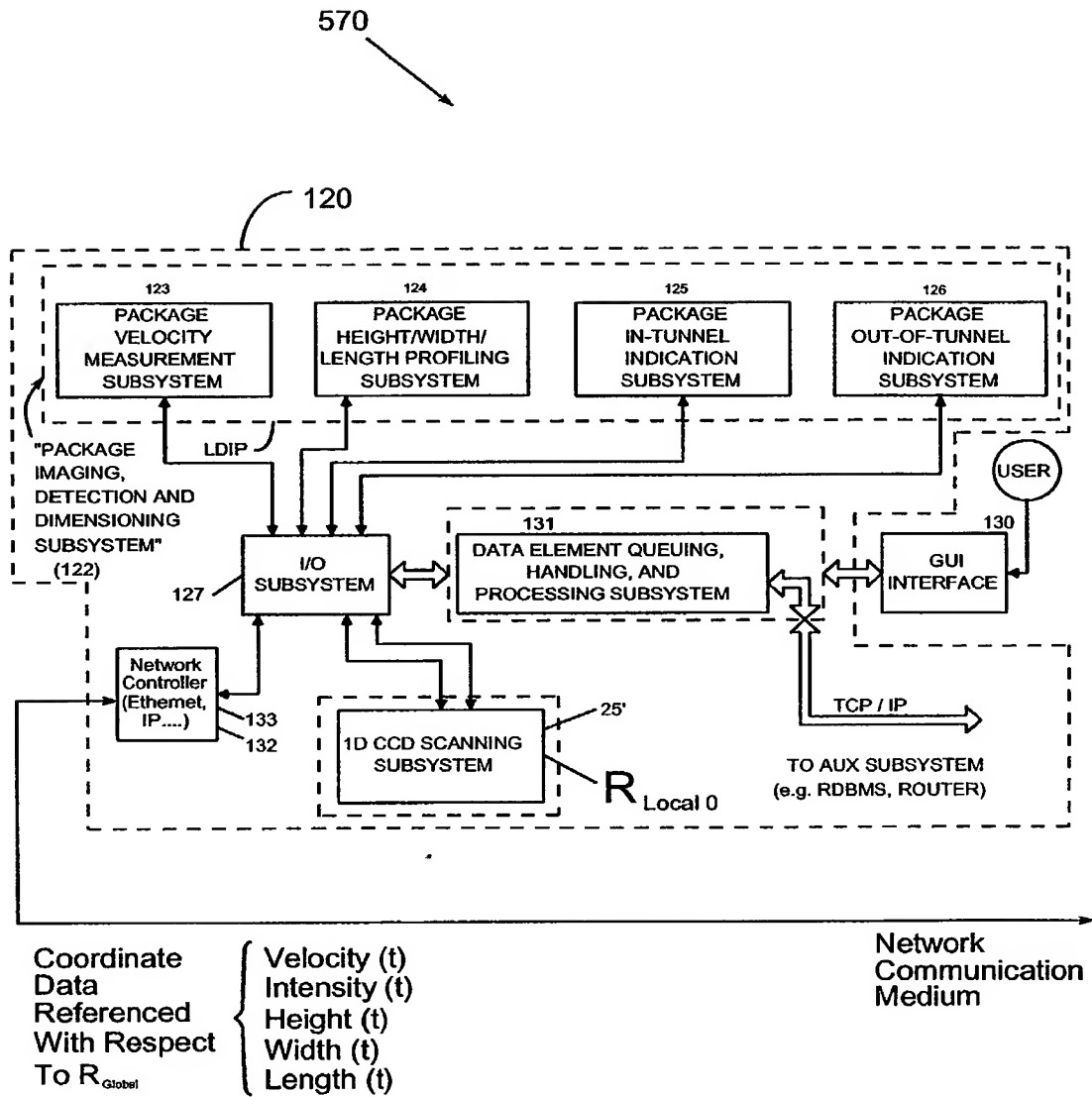


FIG. 30-1

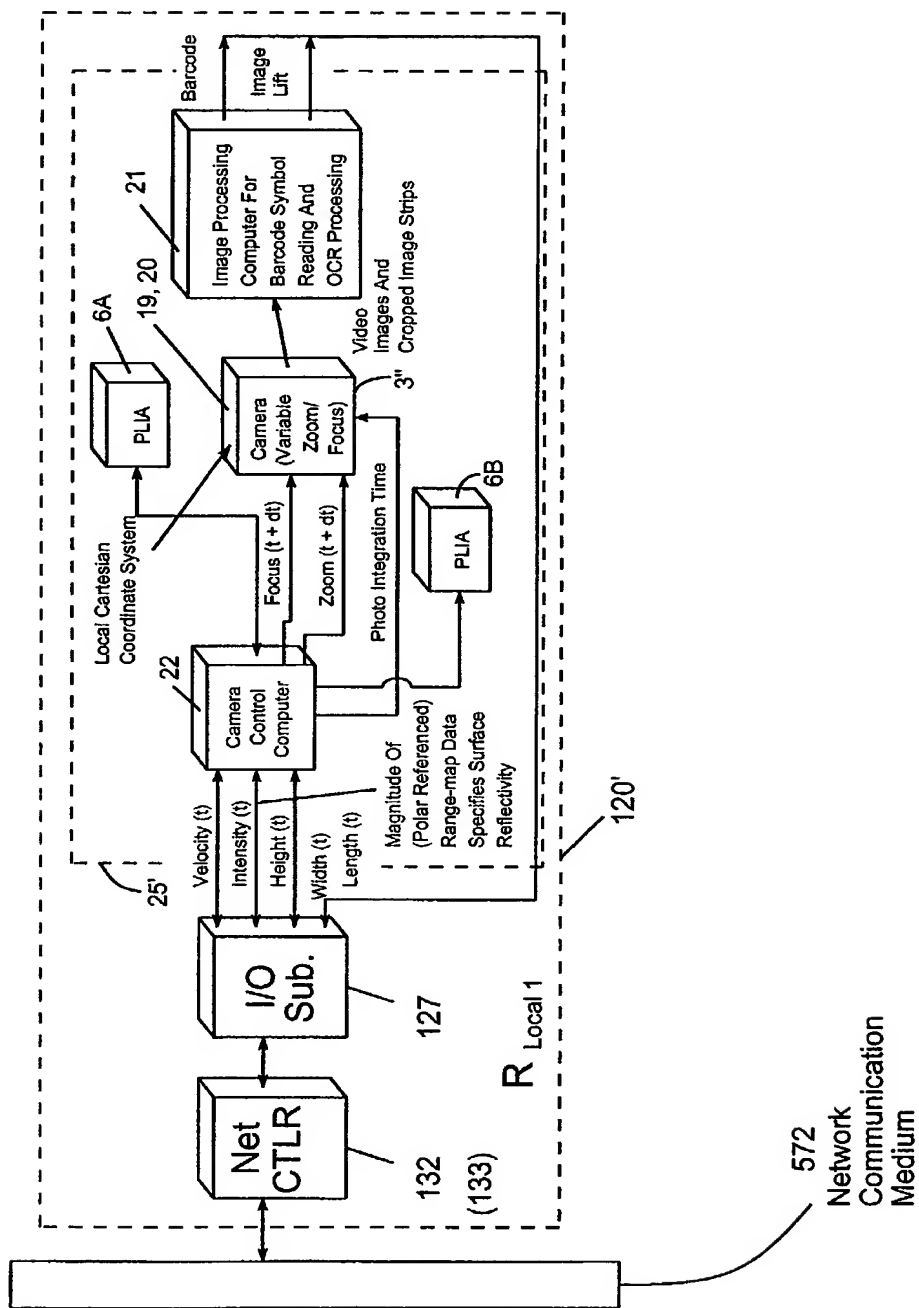


FIG. 30-2

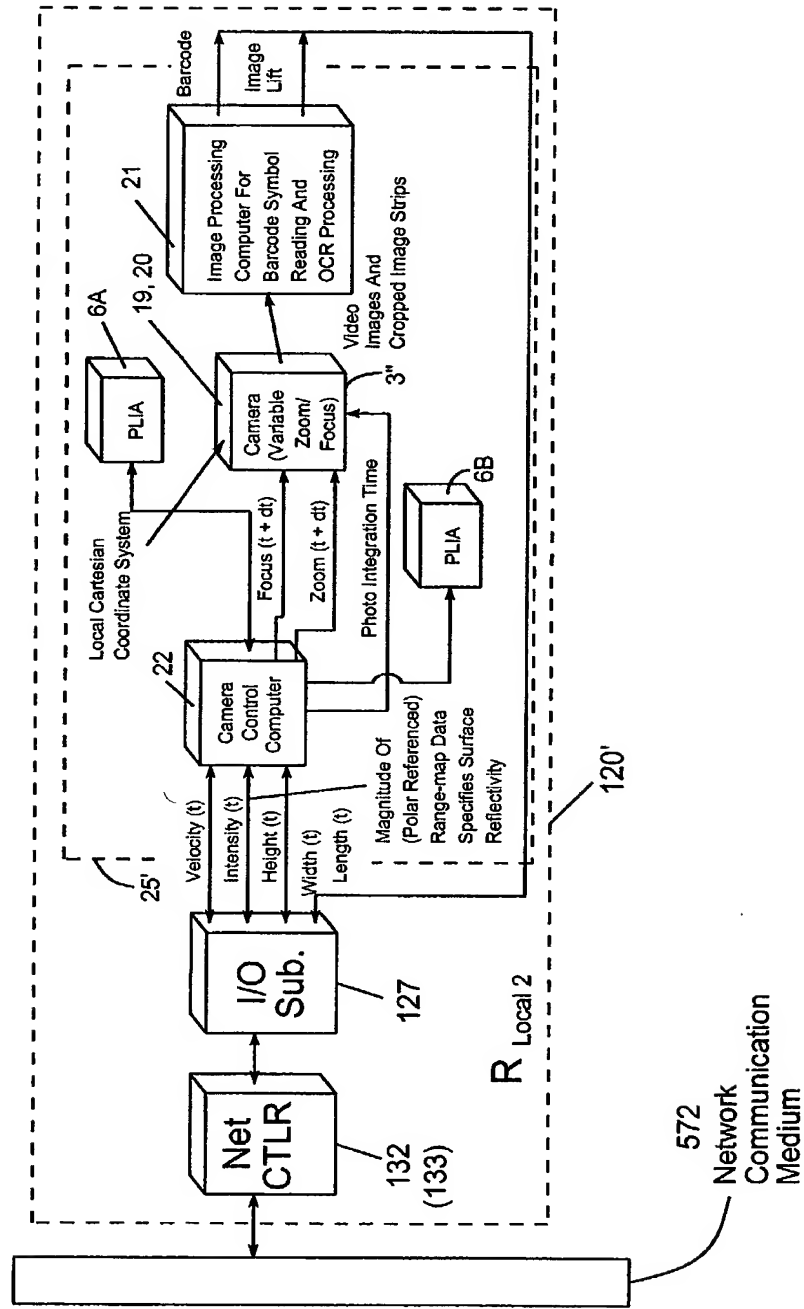


FIG. 30-3



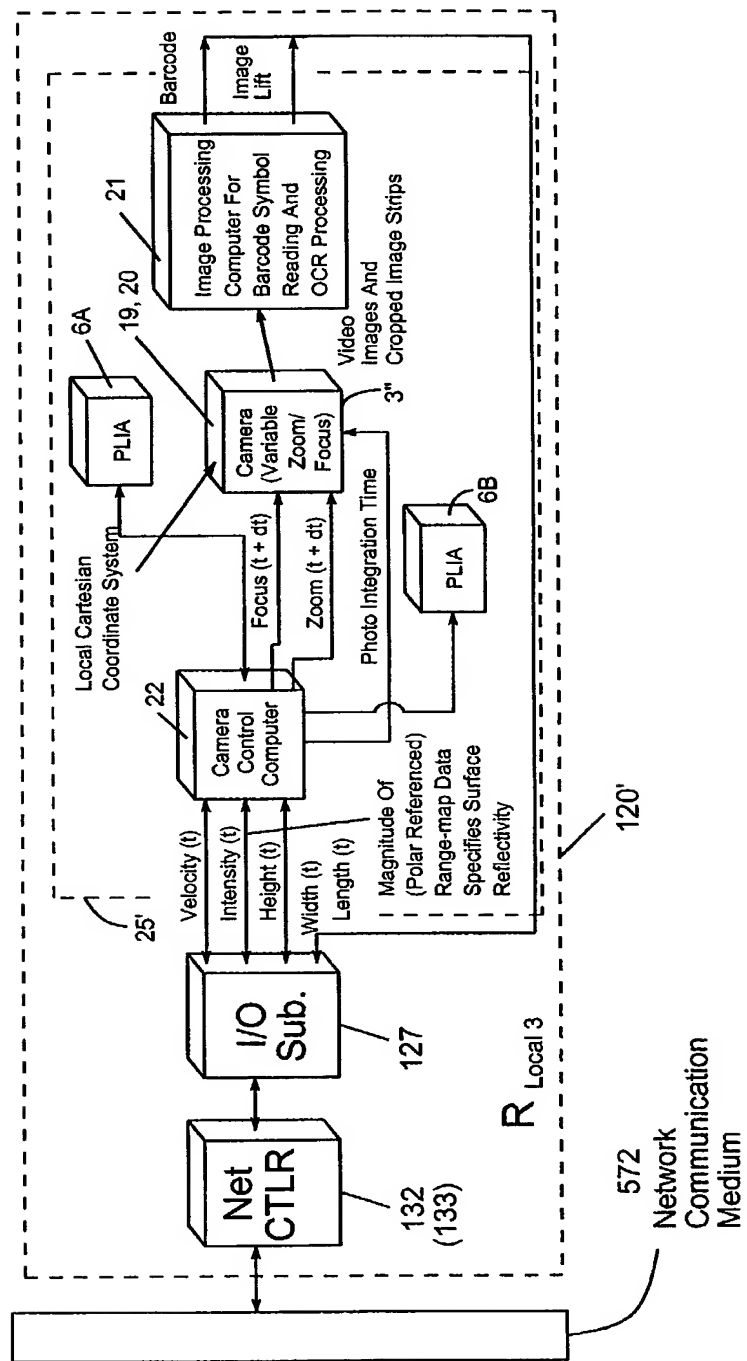


FIG. 30-4

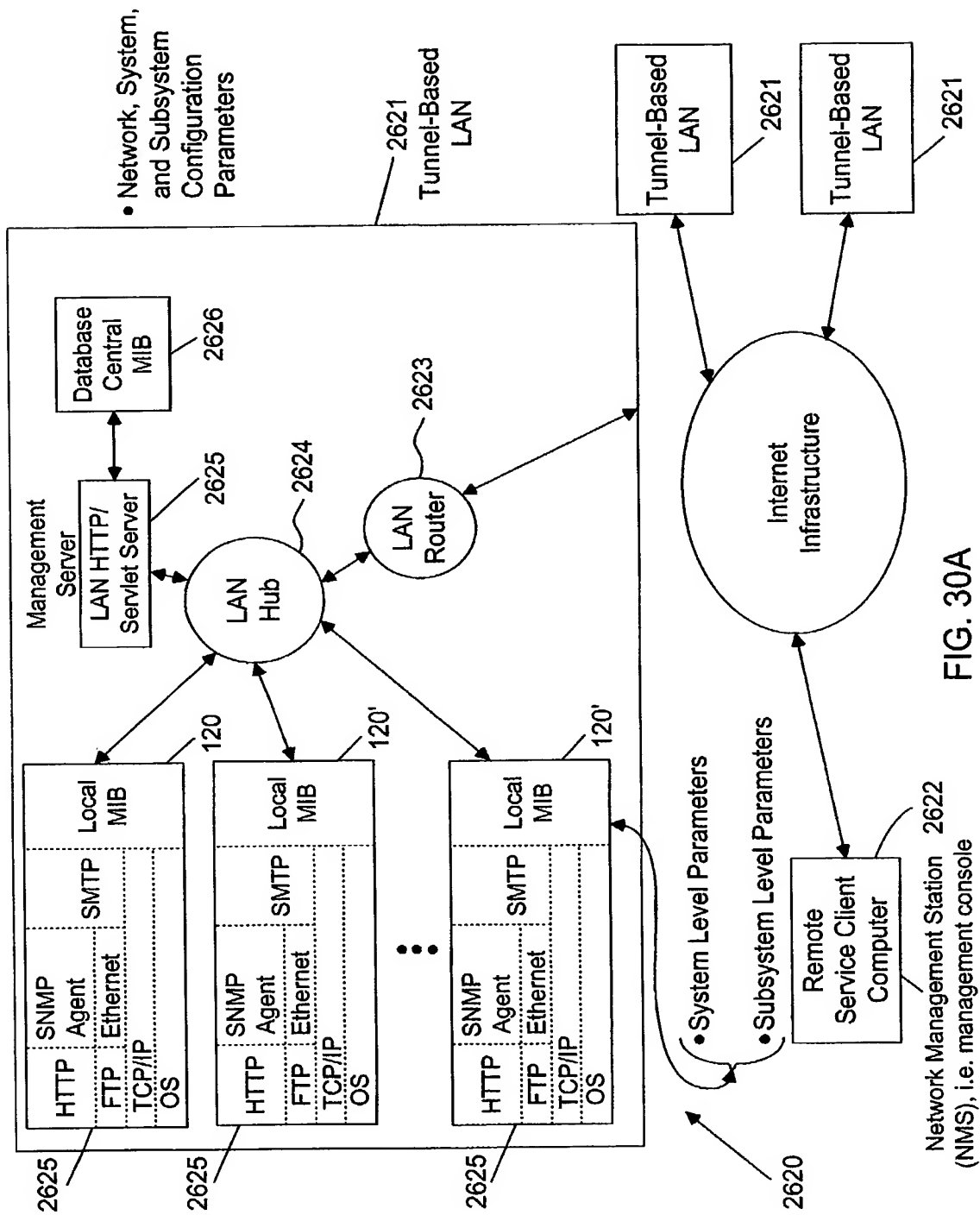


FIG. 30A

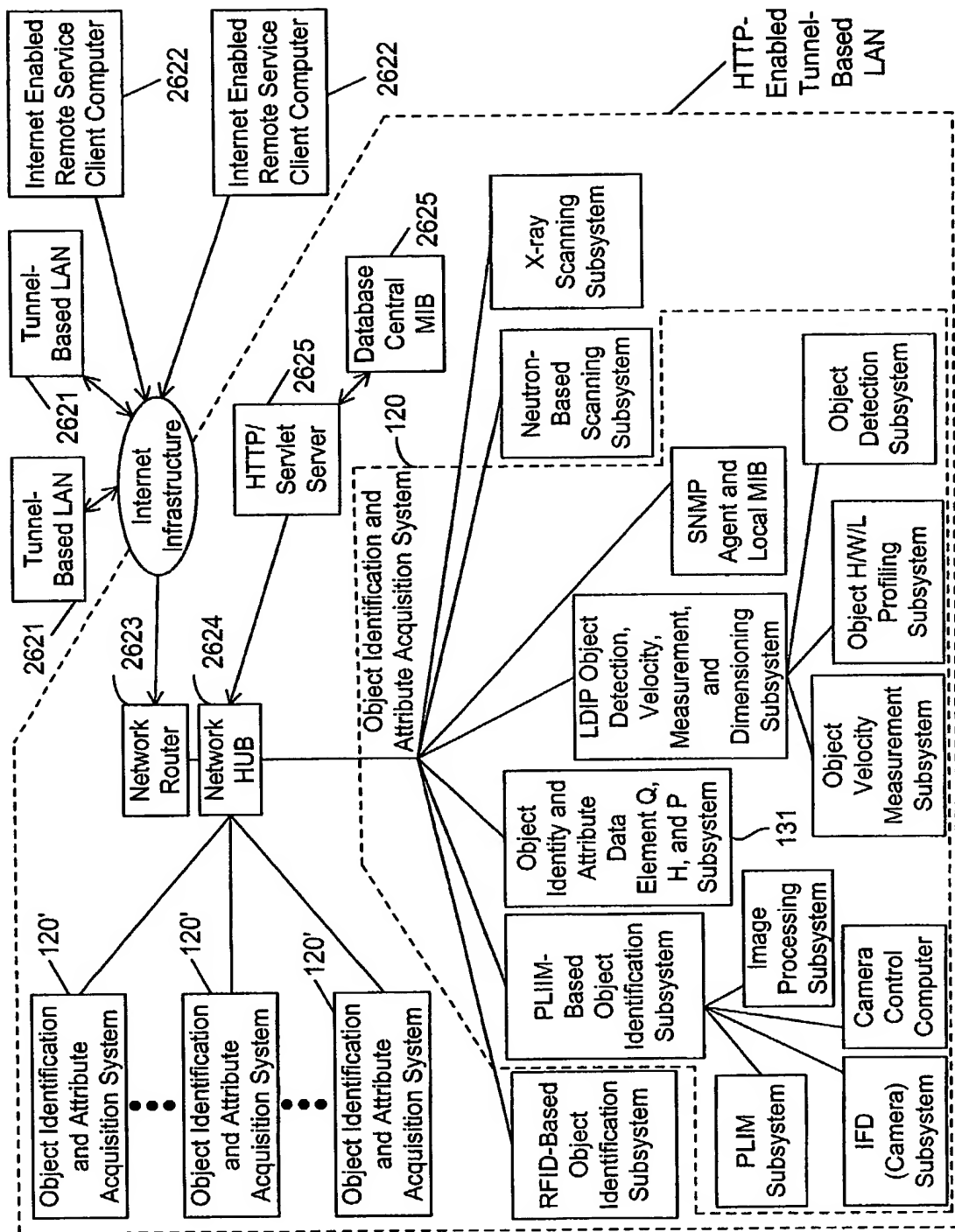


FIG. 30B

### Network Configuration Parameters:

[ Router IP address; no. of nodes (i.e. systems) in LAN; passwords, LAN location; name of customer facility; technical contact; phone no.; domain name; object identity codes; object attribute acquisition codes;....]

### System Configuration Parameters:

[ System IP Address; passwords; object identity codes; object attribute acquisition codes;....]

These subsystems generate object identity parameters

#### Monitorable and/or Configurable Parameters for Subsystems Within Each System:

- PLIM-based object identification subsystem: [ object identity code; object attribute acquisition codes;....]
- PLIM Subsystem: [VLD status; power VLD; TIM function; temp.;....]
- IFD ( Camera) Subsystem: [sensor temp; .....] ]
- Image Processing Subsystem (Computer): [processor load history; system up time; # of frames (pgs); barcode read rate; current line rate;....]
- Camera Contact Subsystem (Computer): [number of frames dropped; number of focused zoom commands; number and kinds of motor control errors;....]
- RFID-based object identification subsystem: [....]
- Object identity and attribute data element queuing, handling and processing subsystem: [....]
- LDIP object identification, velocity-measurement, and dimensioning subsystem: [....]
- Object velocity measurement subsystem: [polygon RPM; polygon laser output X; channel X drift; channel X noise; trigger error events; instant lock reference drift; temperature]
- Object H/W/L profiling subsystem
- Object detection subsystem: [non- singulation/ singulation code;....]

This system links object attribute data element parameters(i.e. object identity data element) to corresponding object identity parameters (i.e. object attribute data element)

These subsystems generate object attribute parameters

- X-ray scanning subsystem: [....]

- Neutron-beam scanning subsystem: [....]

FIG. 30C

- 1 / 17

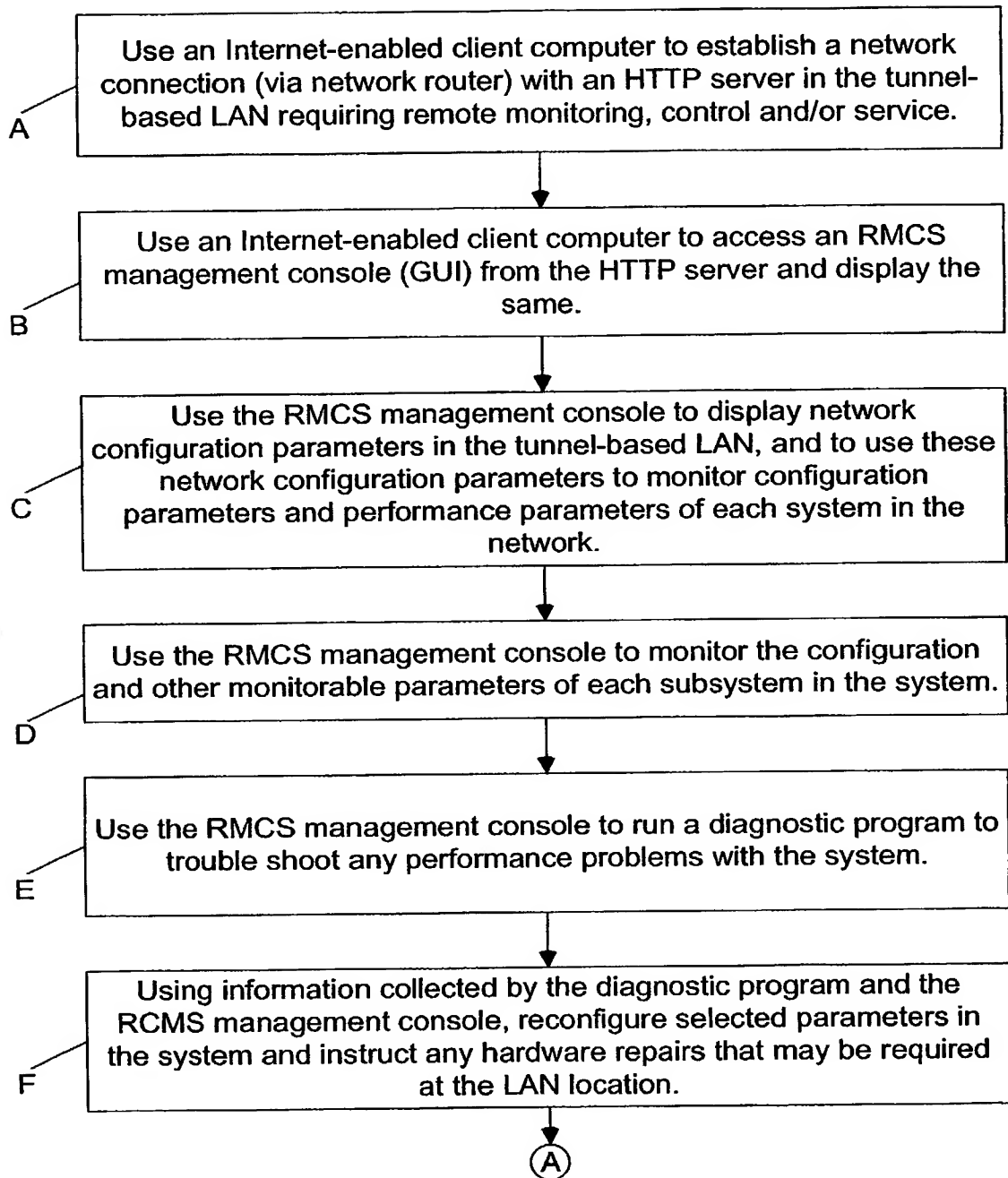


FIG. 30D1

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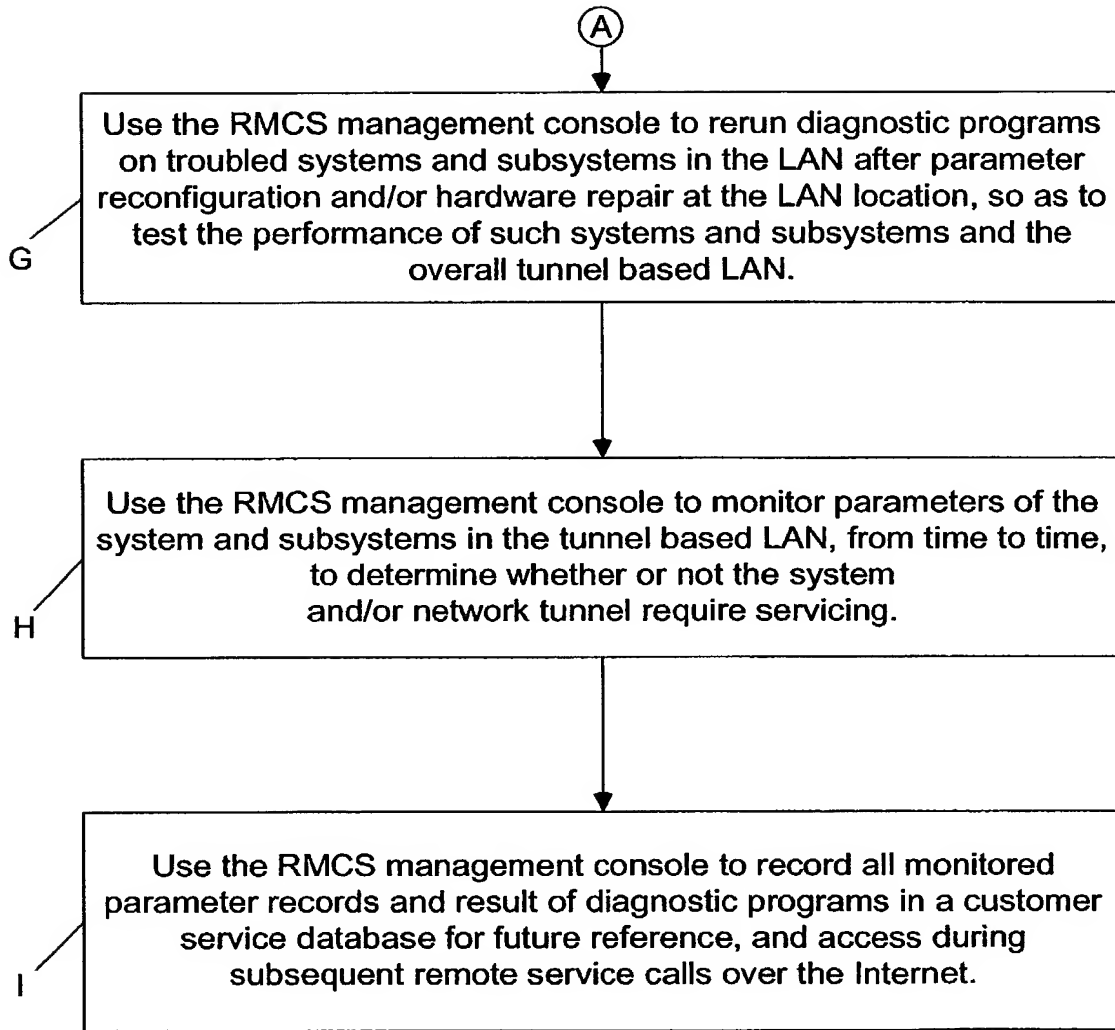


FIG. 30D2

CCD Camera-Based Tunnel System  
Employing Package Coordinate Data  
Driven Method Of Automatic Camera  
Zoom And Focus Control

Package Dimensioning  
 Subsystem And  
 Package Velocity  
 Detection Subsystem

Master Unit  
 120 (122)  
 $R_{Local\ 0}$

Dimensioner Field  
 Of View

(Slave Unit #1)  
 $R_{Local\ 1}$

Encoder  
 576

(Slave Unit #2)  
 $R_{Local\ 2}$

(Slave Unit #3)  
 $R_{Local\ 3}$

570

Camera Field  
 Of View

571A

573

Camera Field Of View

571B

+V

+Z

+X

Package Coordinate Data I  $R_{Global}$   $\xrightarrow{HG}$  Package Coordinate Data II  $R_{Local\ i}$

FIG. 31

1 2 3

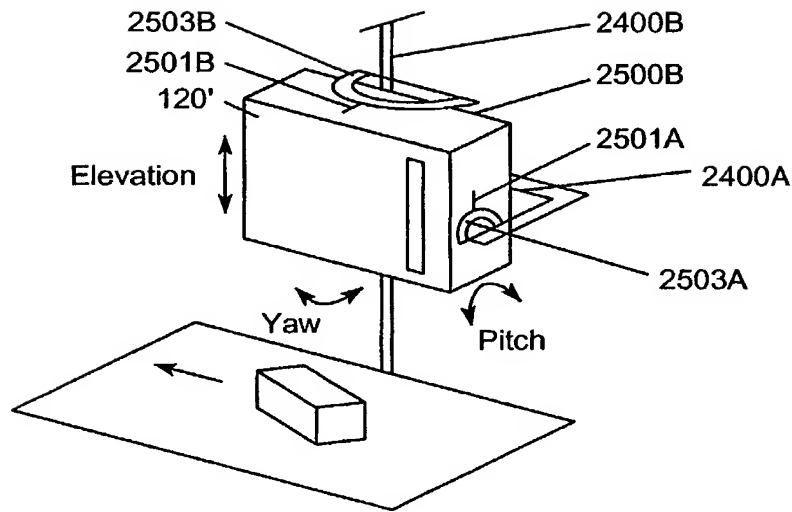


FIG. 31A



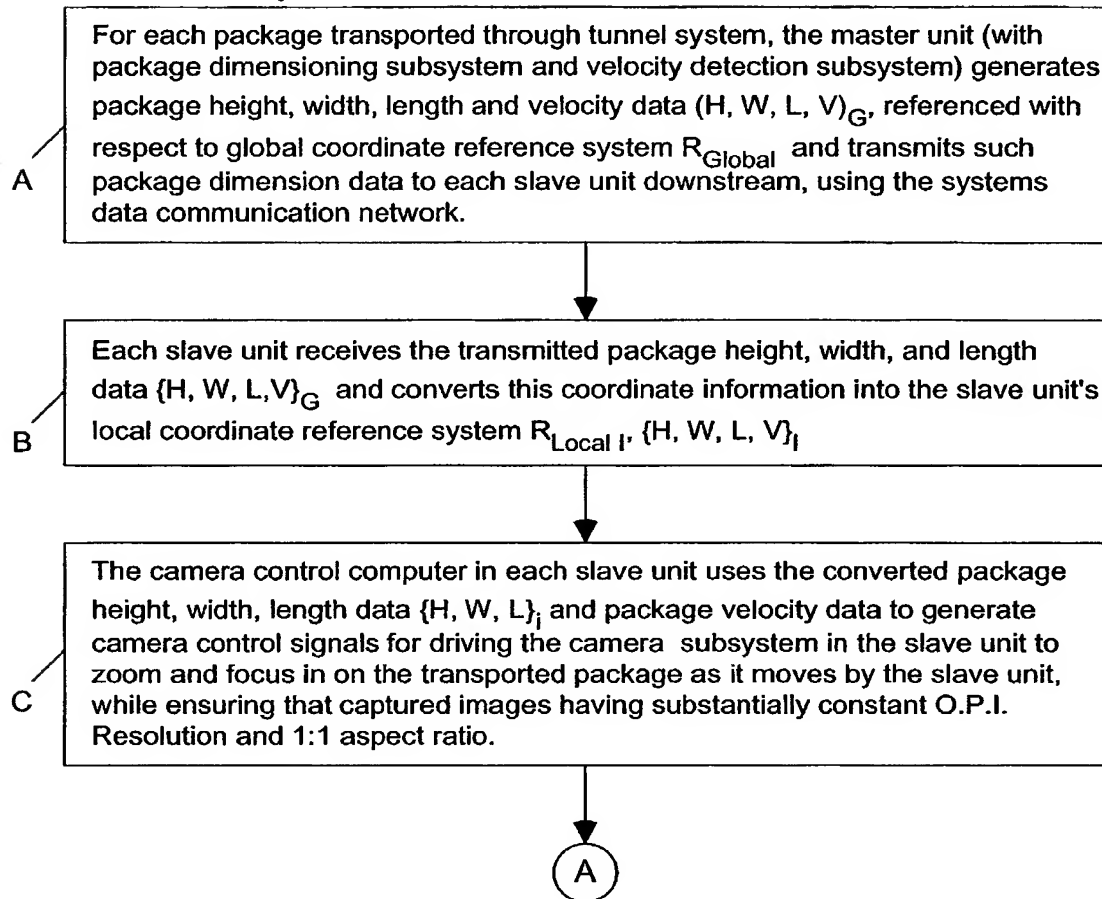


FIG. 32A

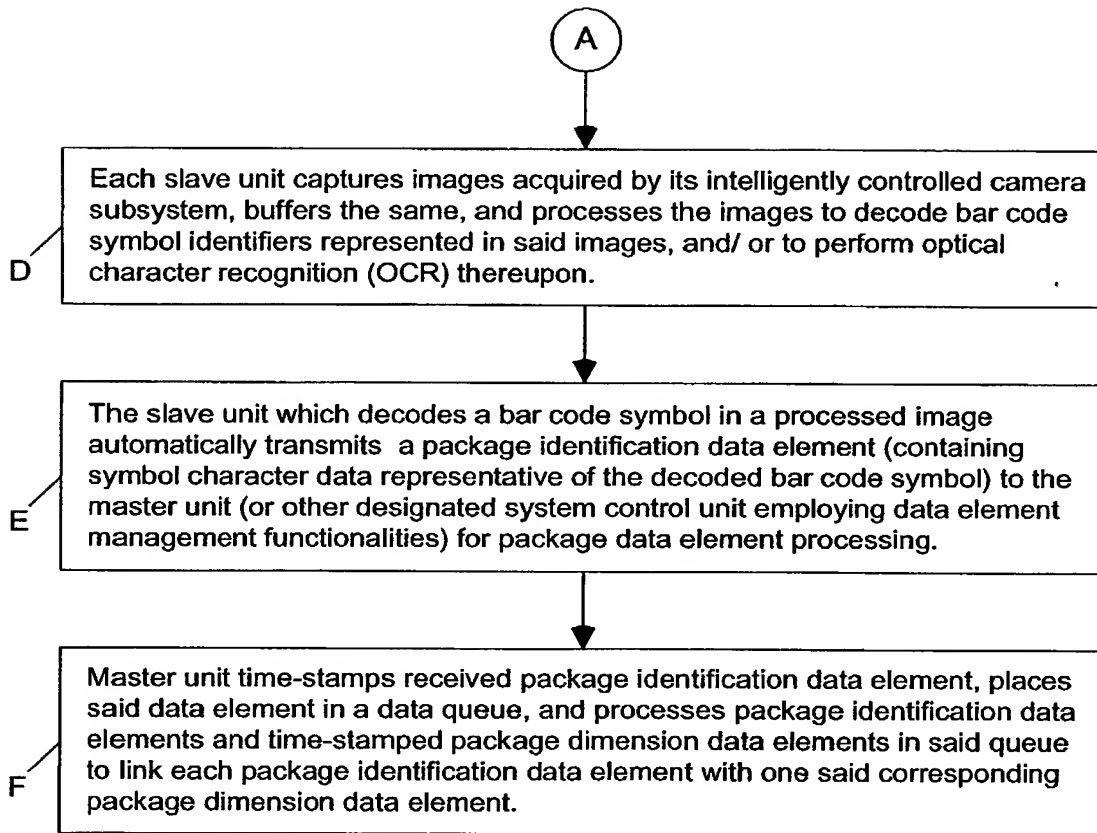


FIG. 32B

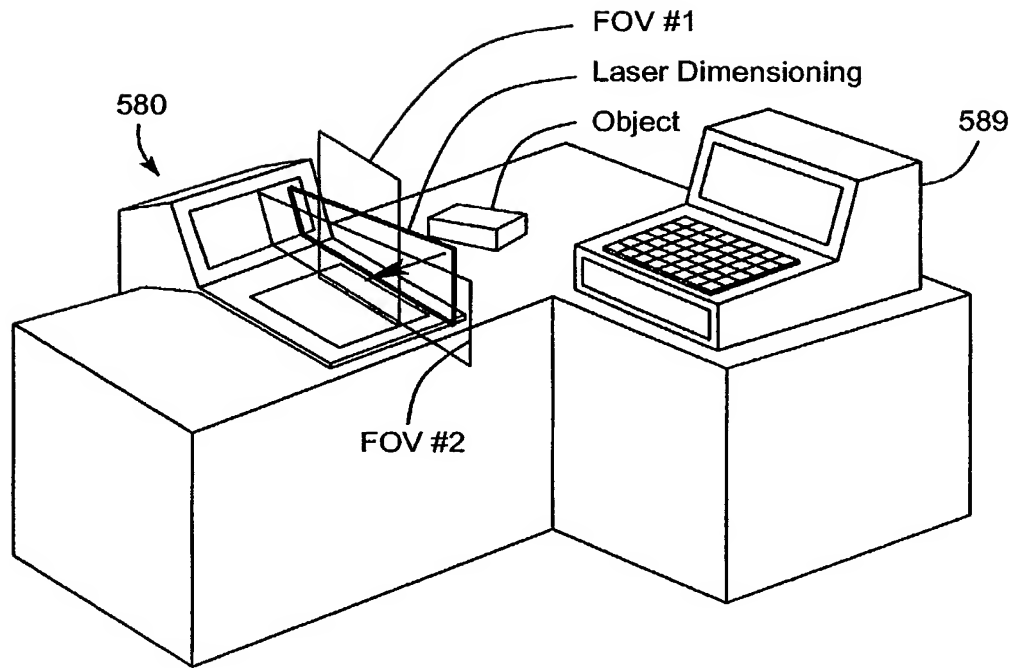


FIG. 33A

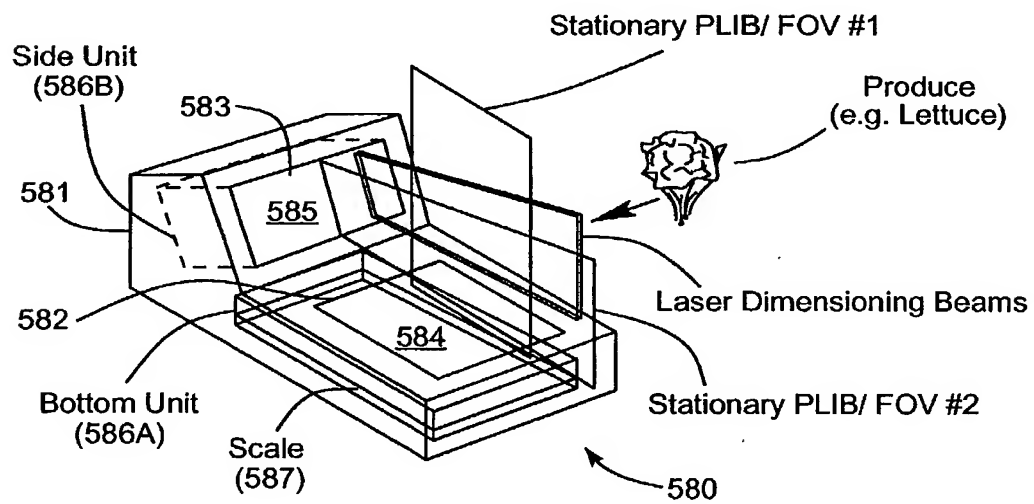
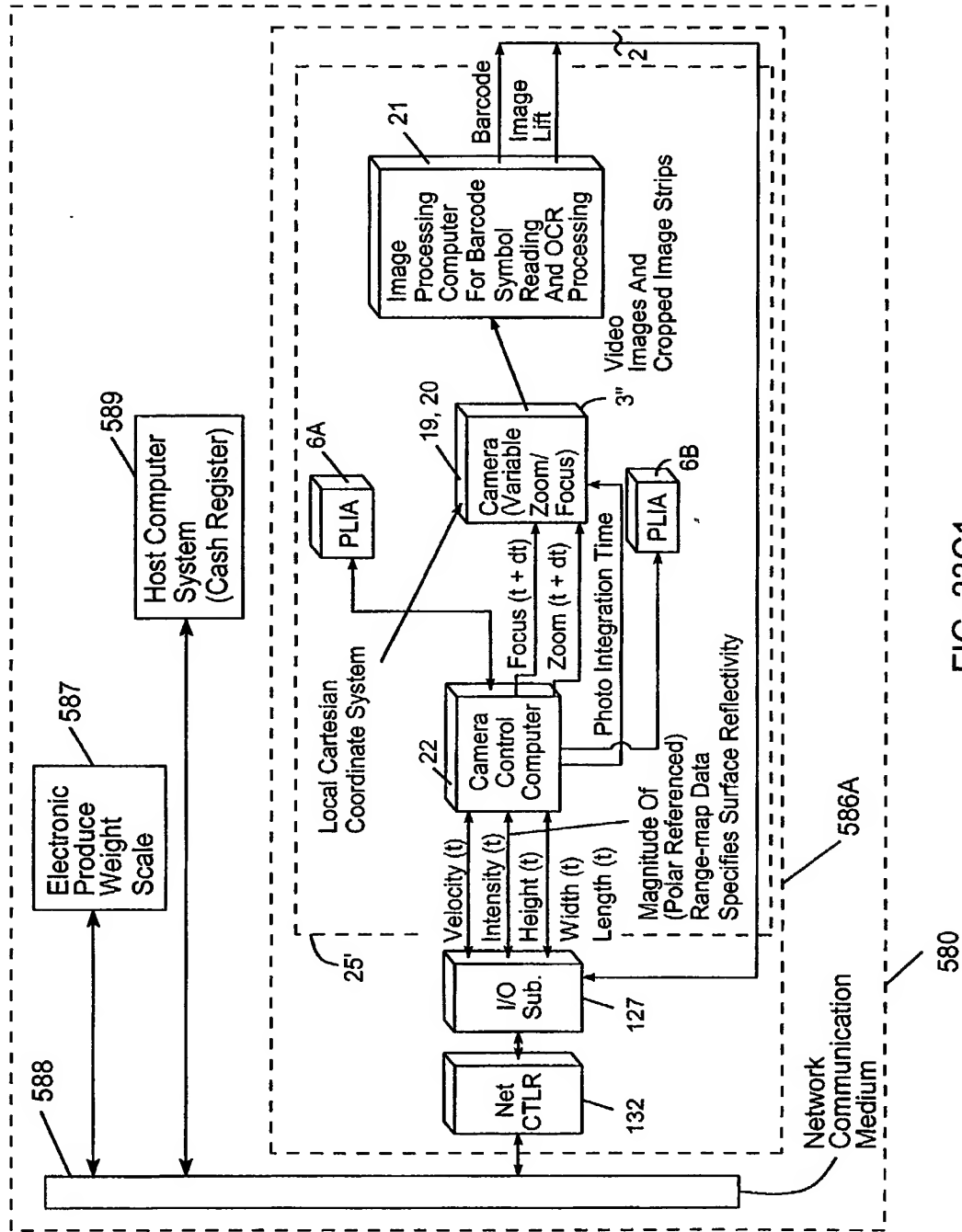


FIG. 33B



**FIG. 33C1**

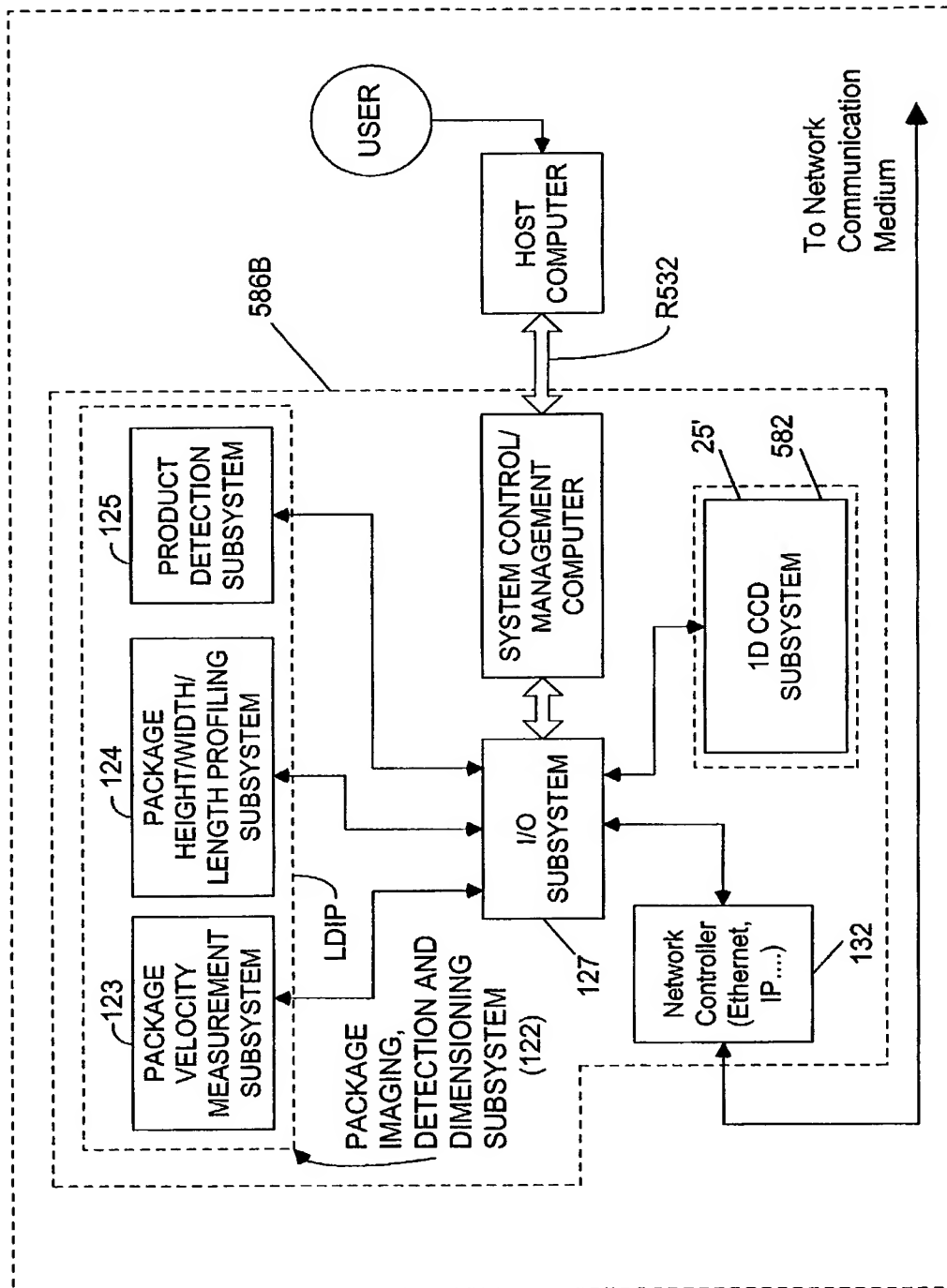


FIG. 33C2

580

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

FIG. 33C2

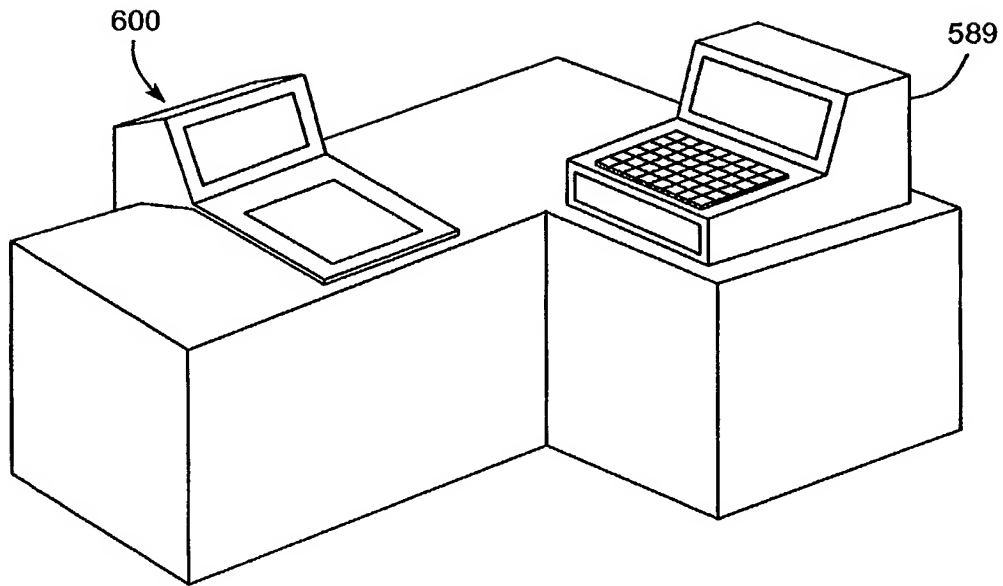


FIG. 34A

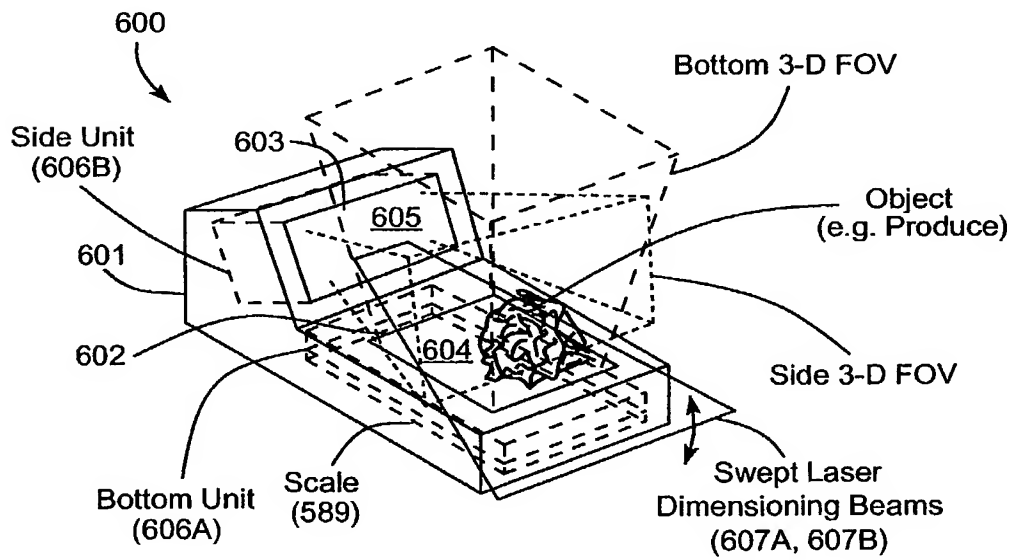


FIG. 34B

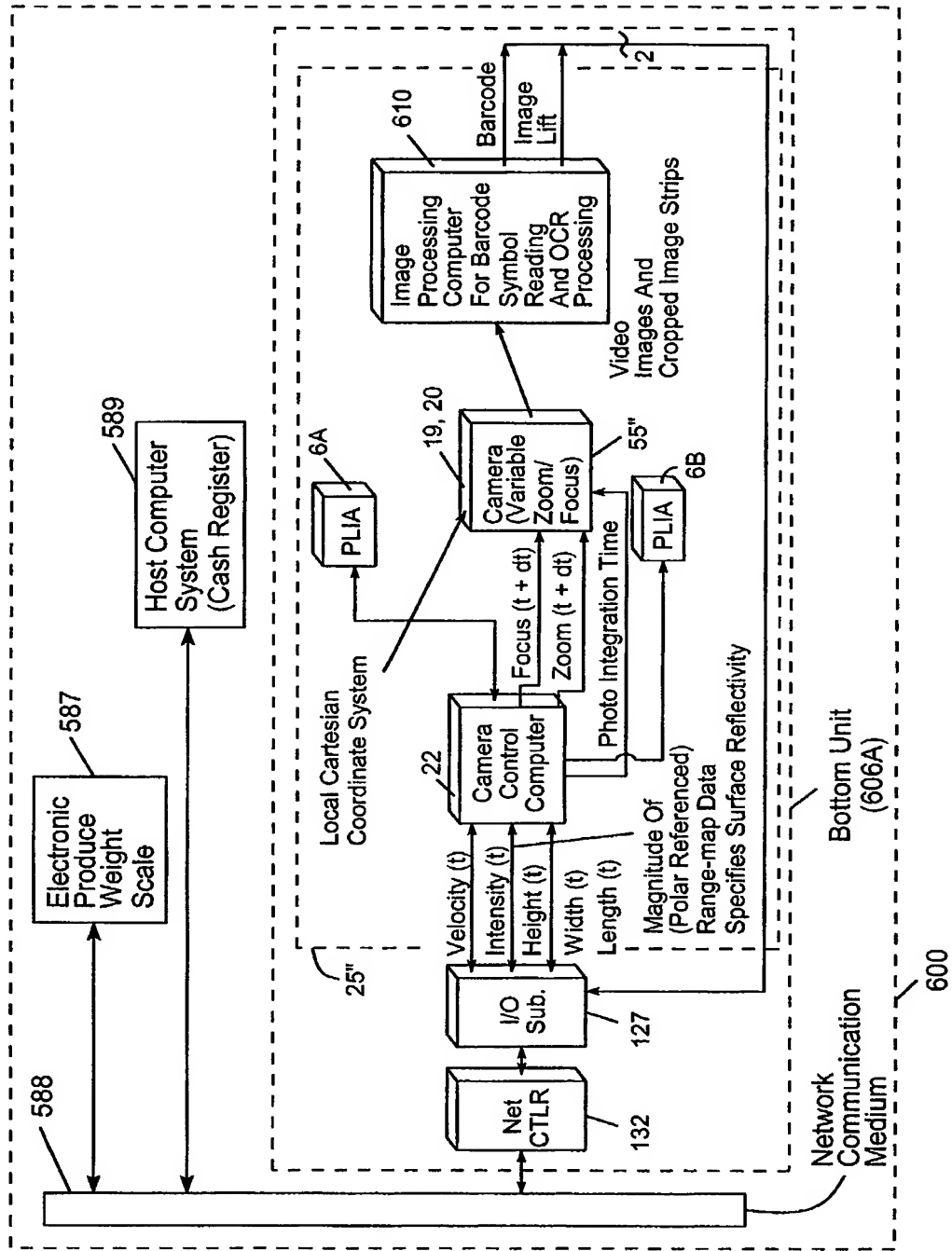


FIG. 34C1

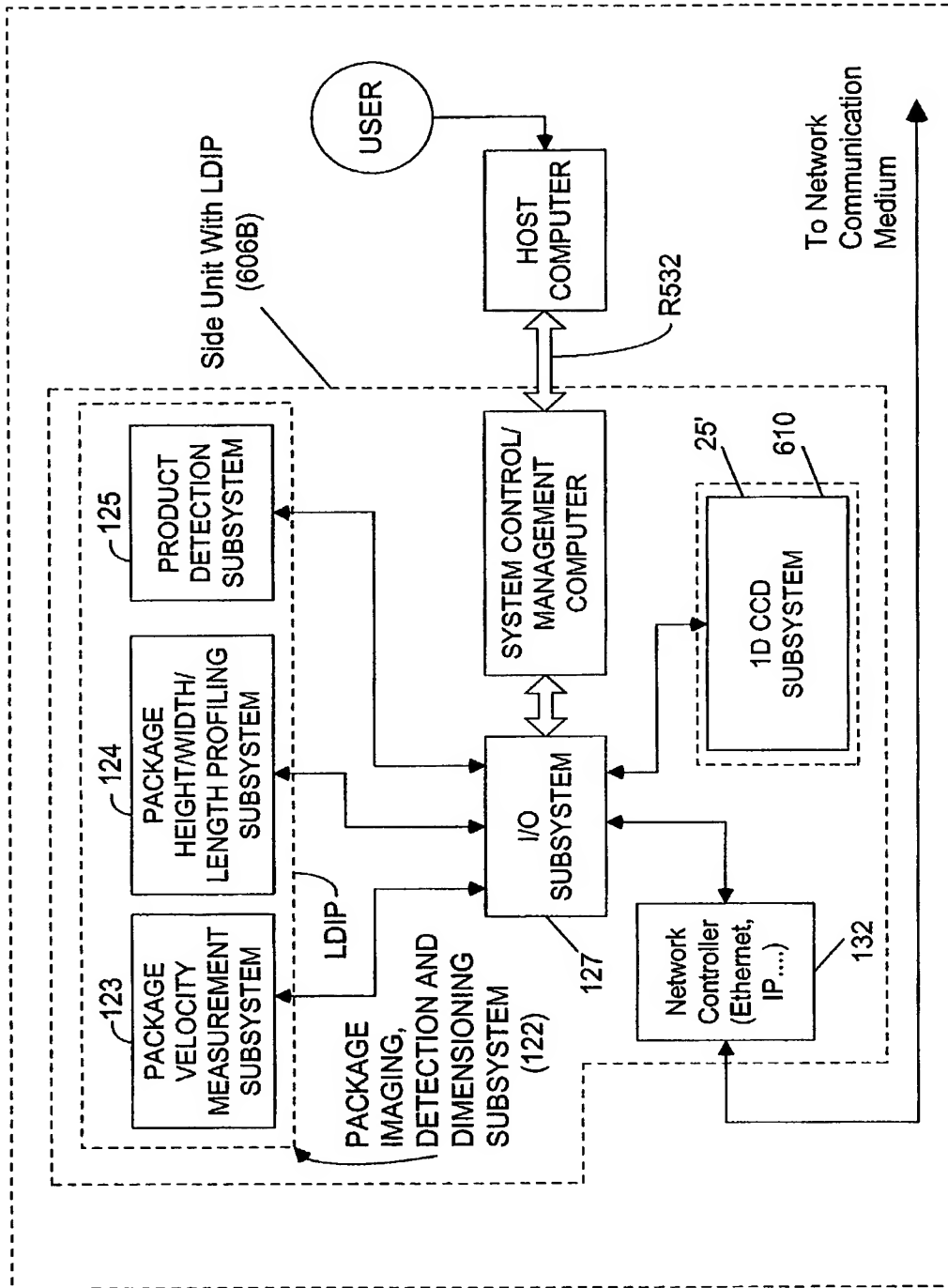


FIG. 34C2



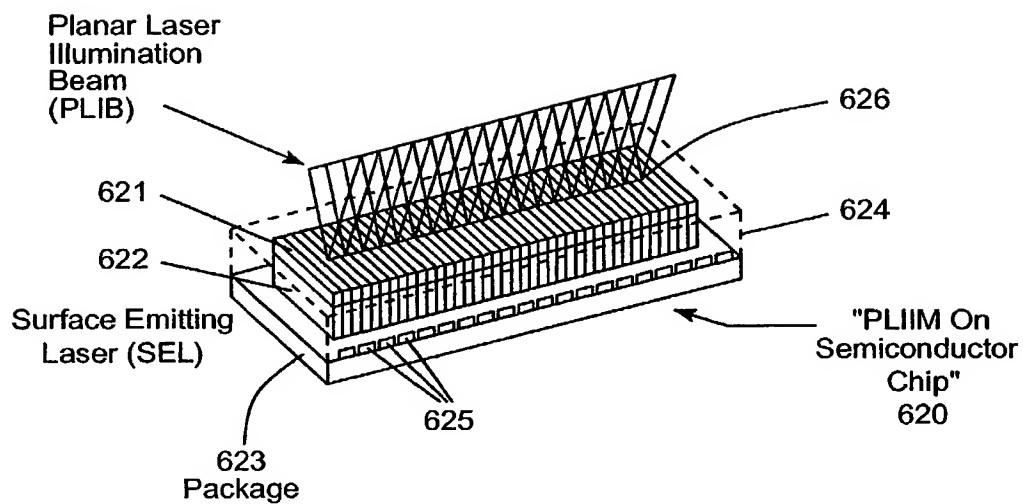


FIG. 35A

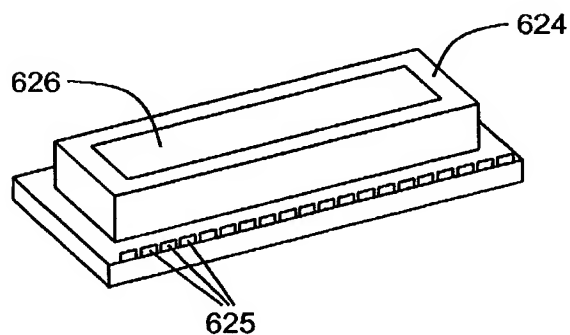


FIG. 35B

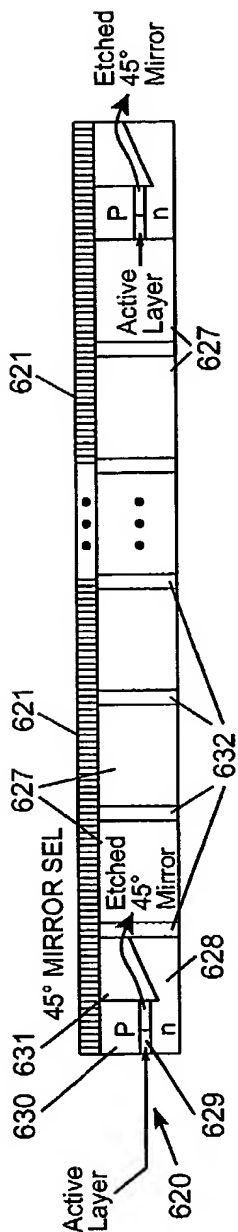


FIG. 36A

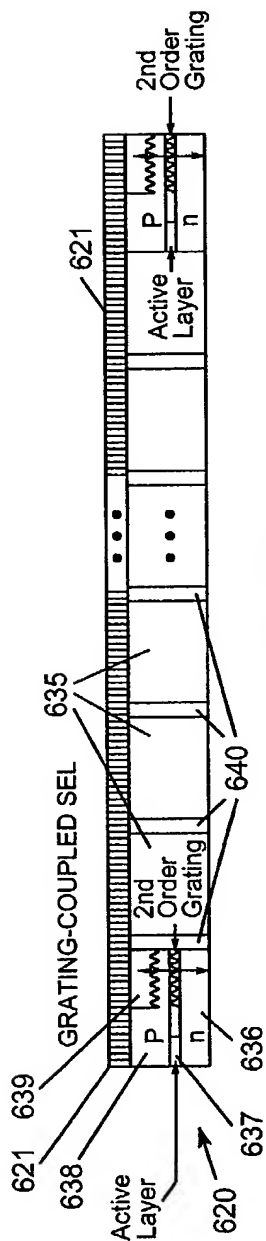


FIG. 36B

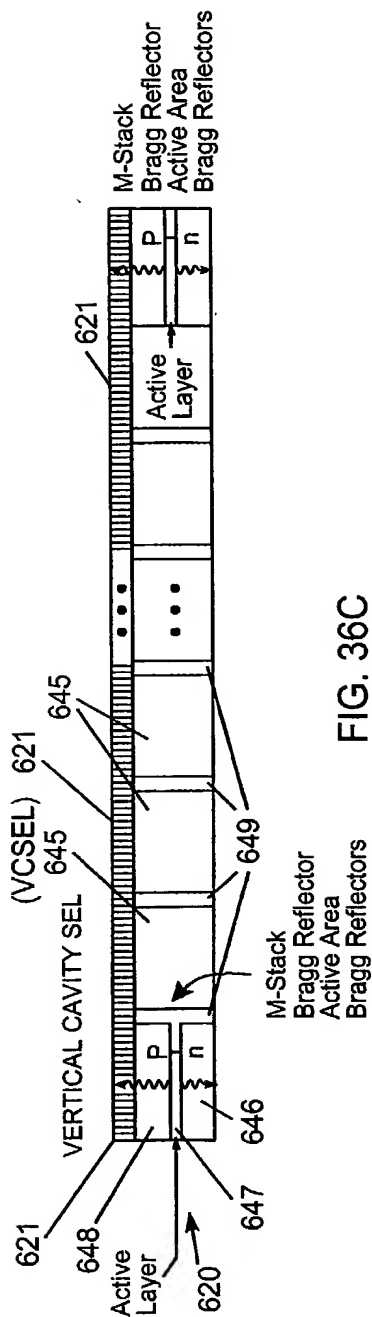


FIG. 36C

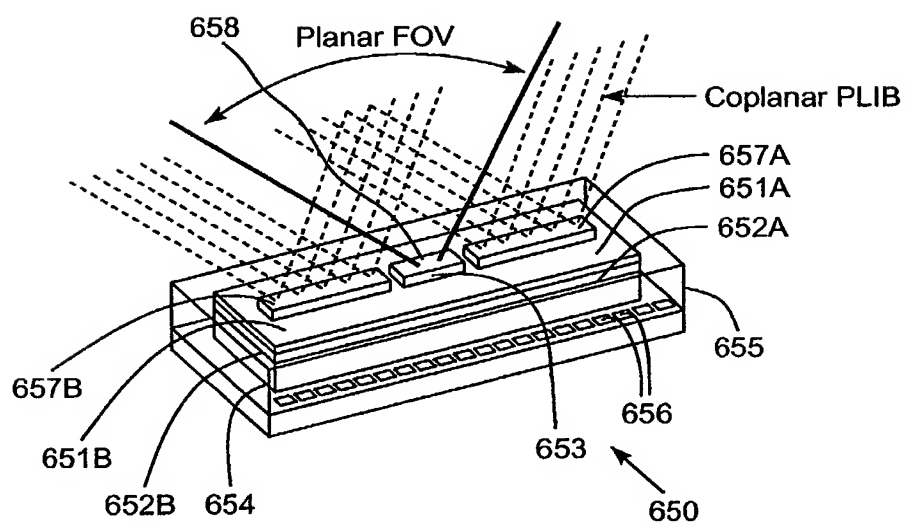


FIG. 37

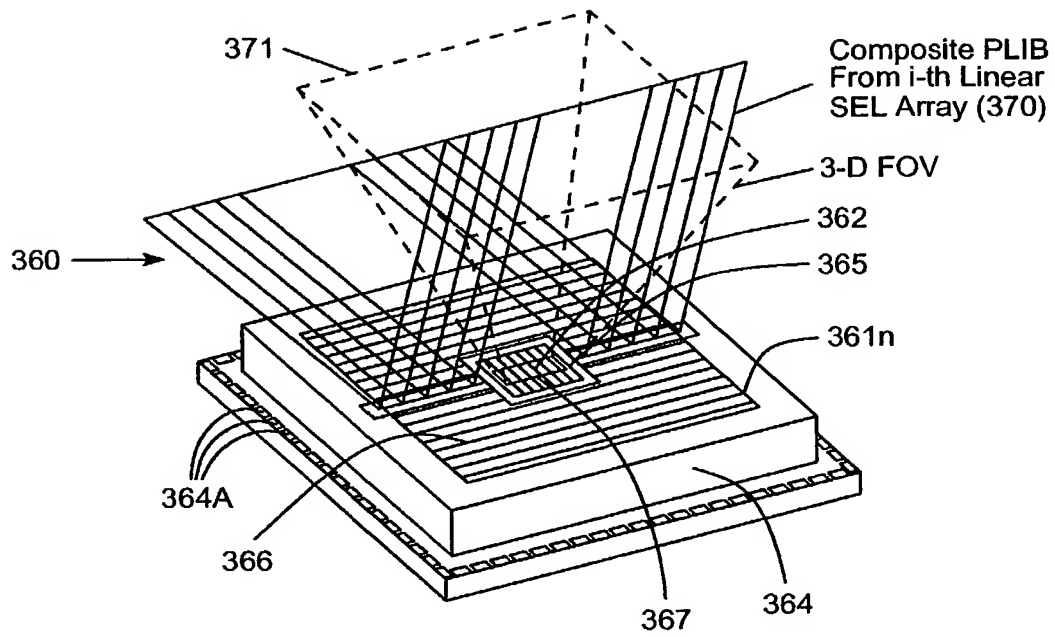


FIG. 38A

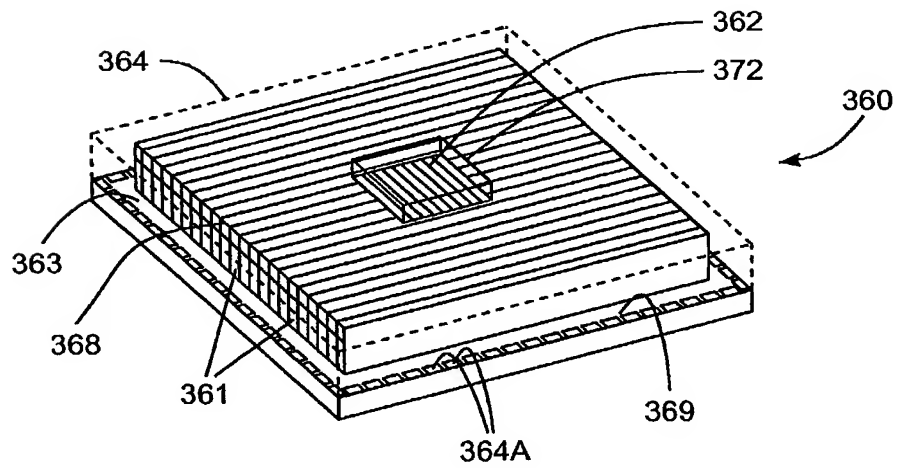


FIG. 38B

1 2 3 4

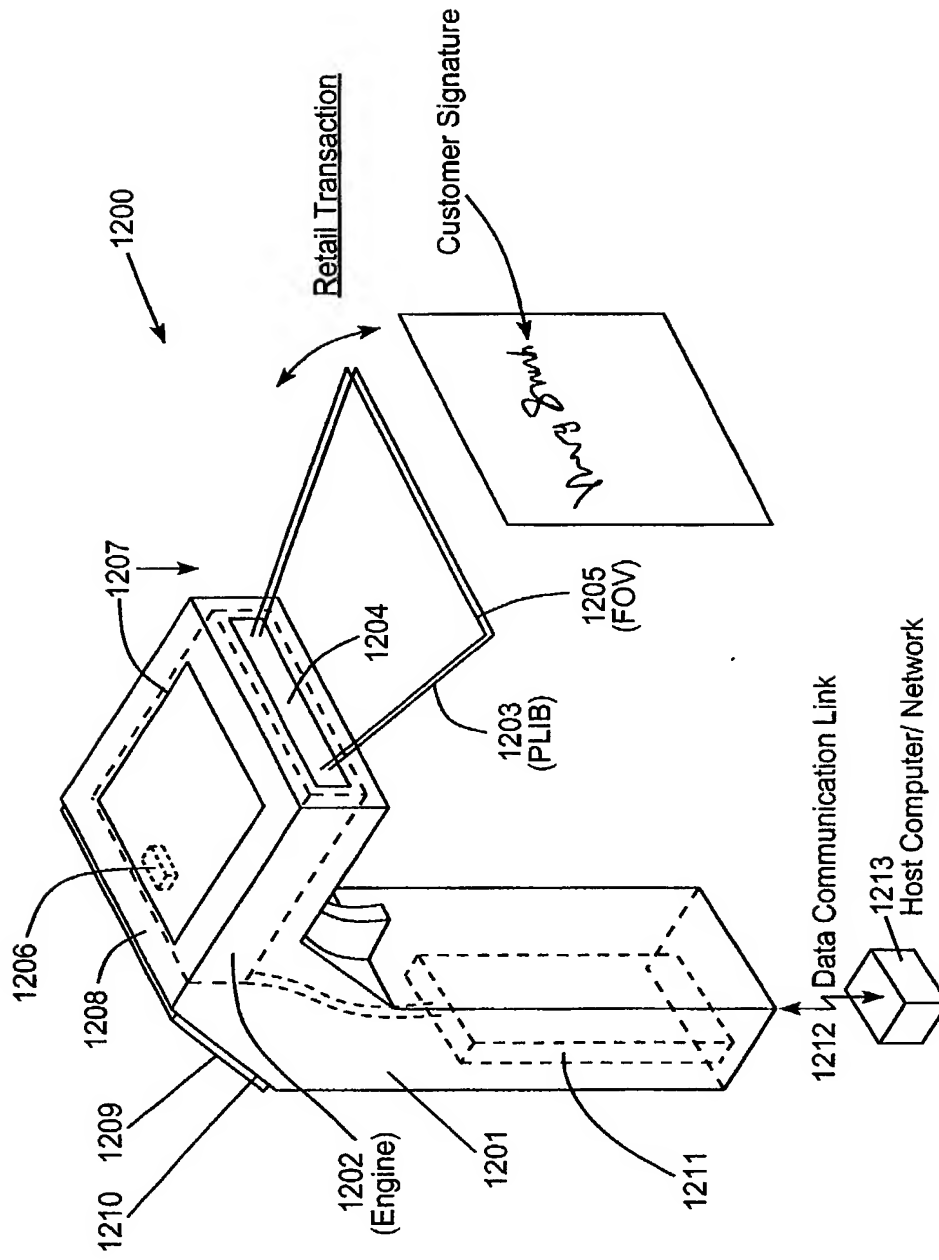


FIG. 39A

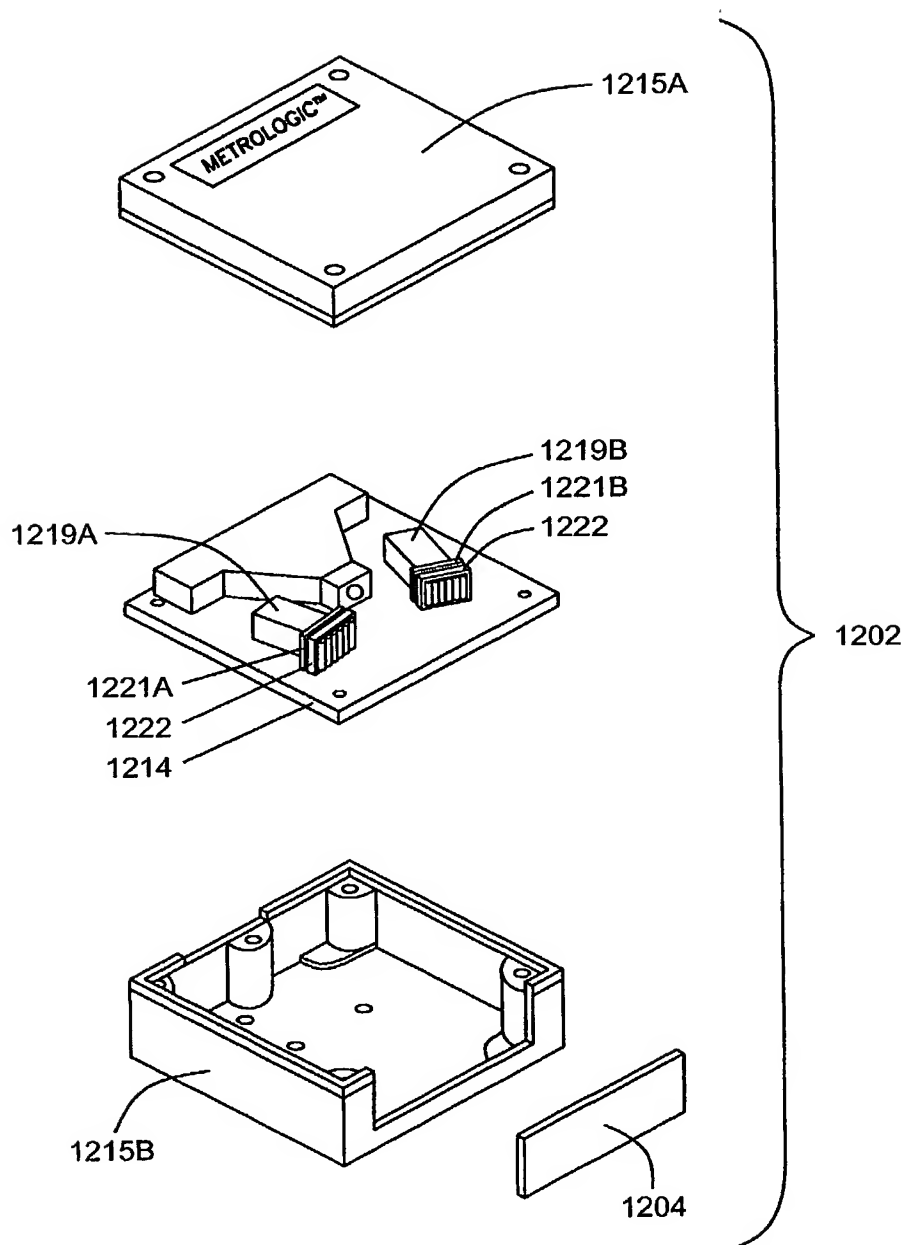


FIG. 39B

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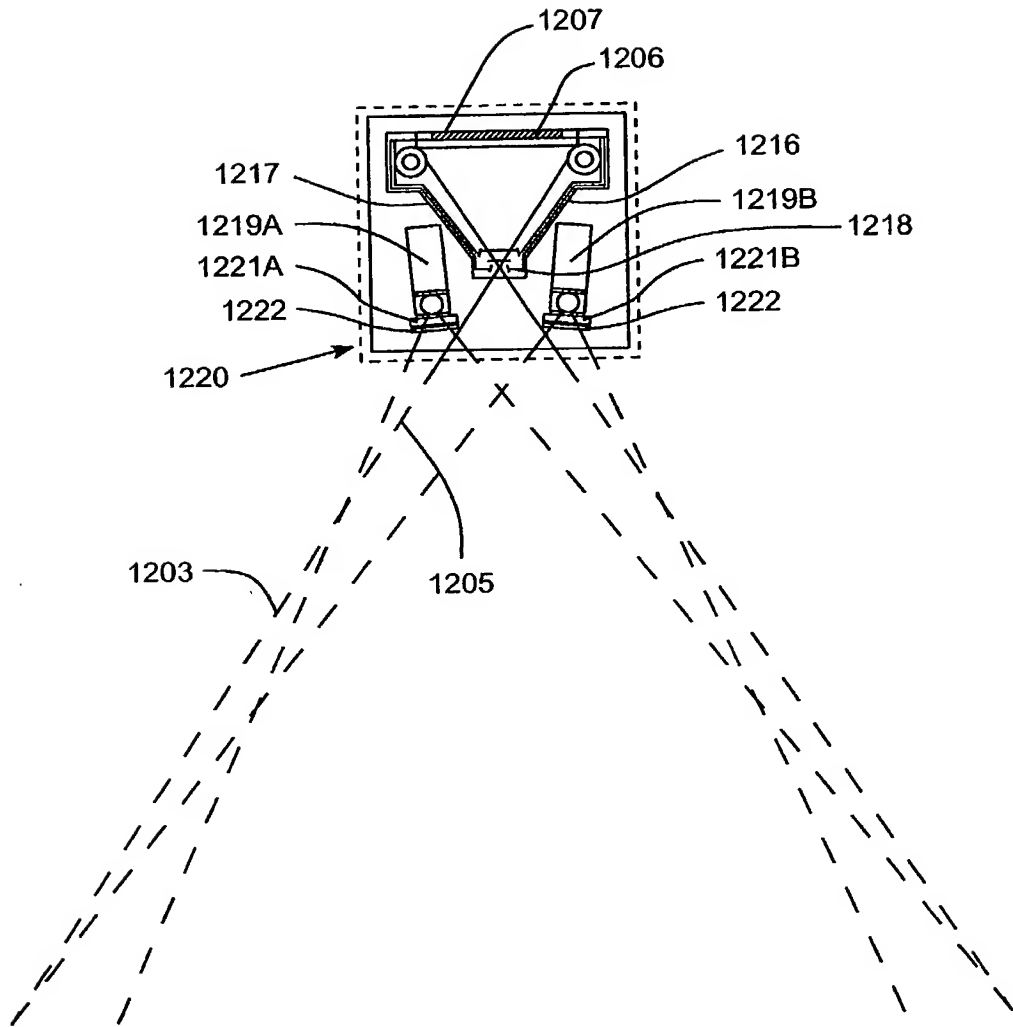


FIG. 39C

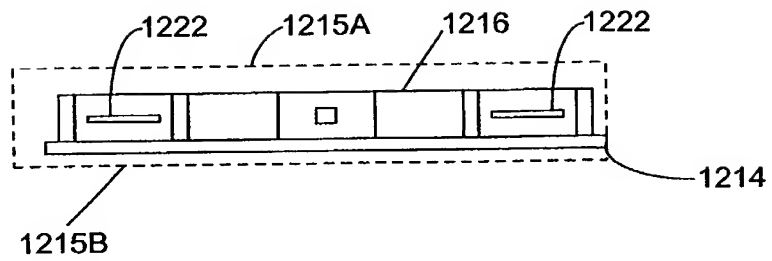


FIG. 39D

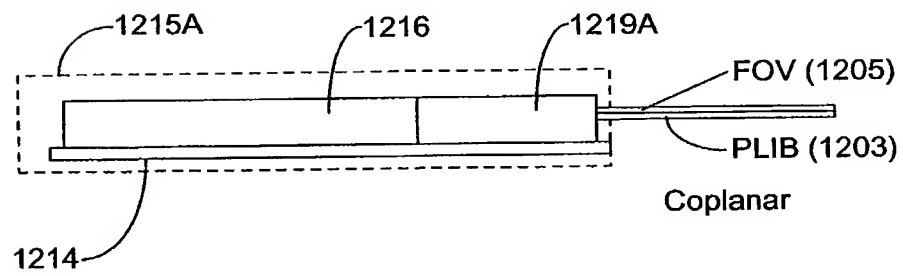


FIG. 39E



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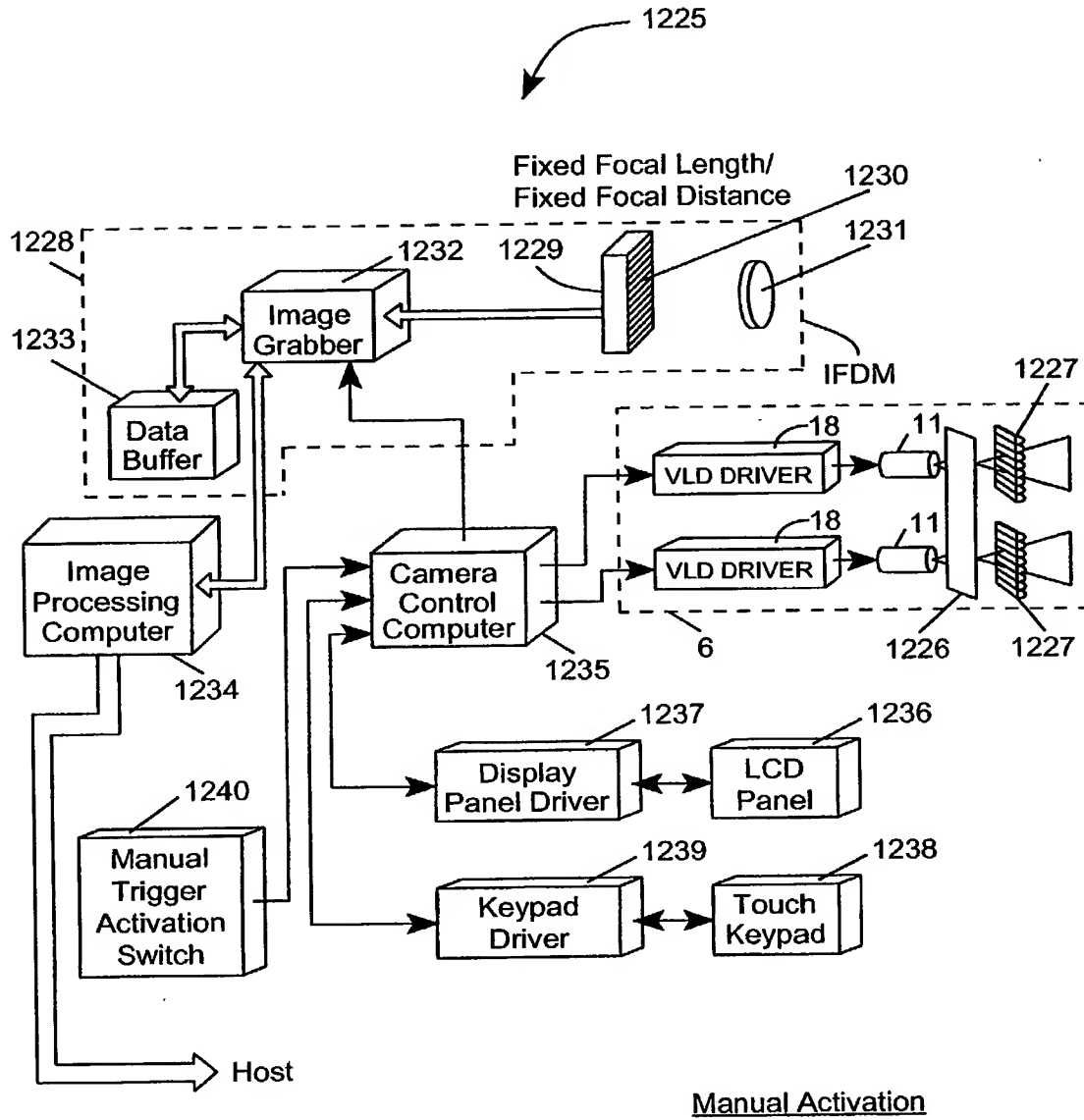
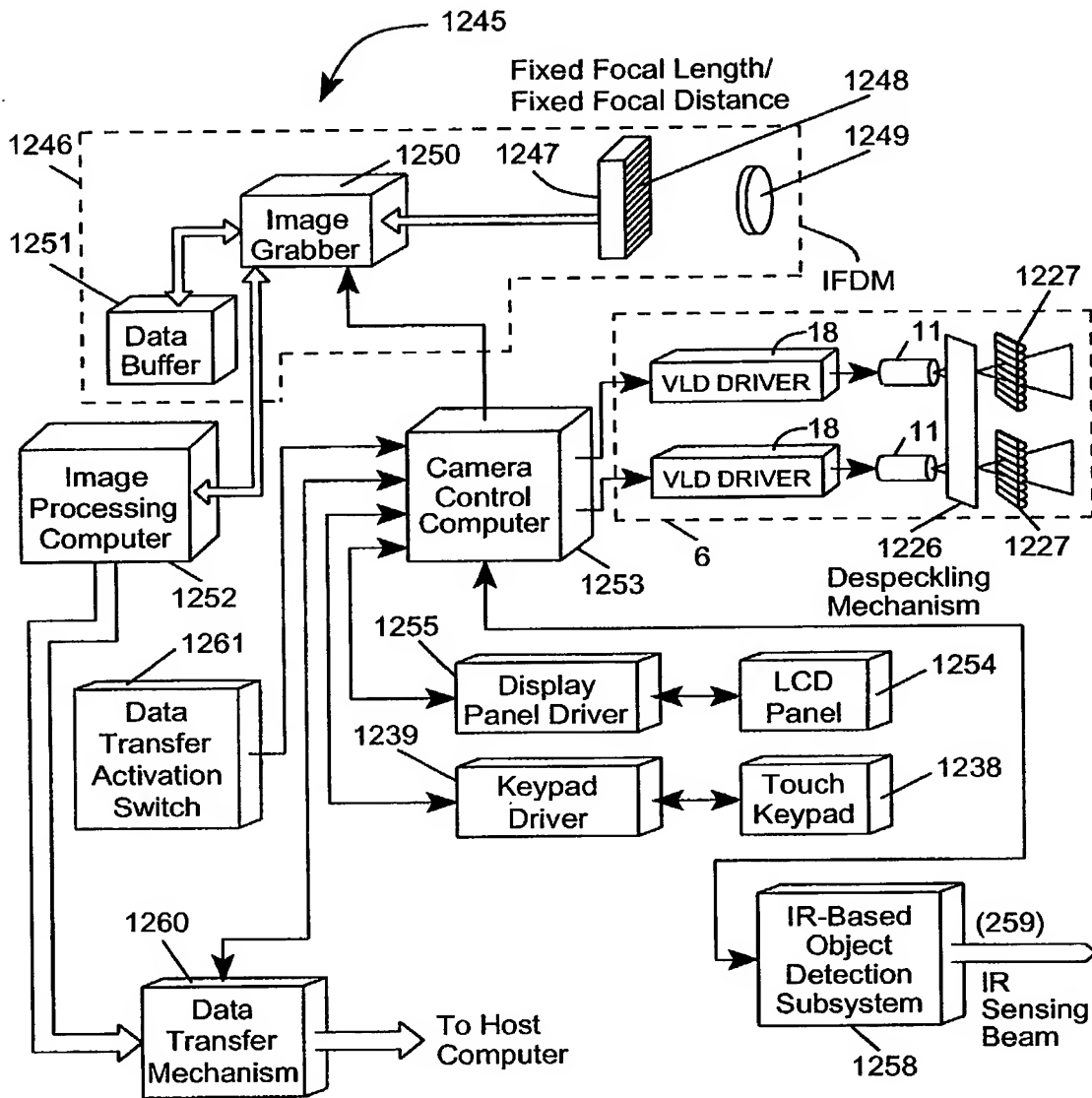


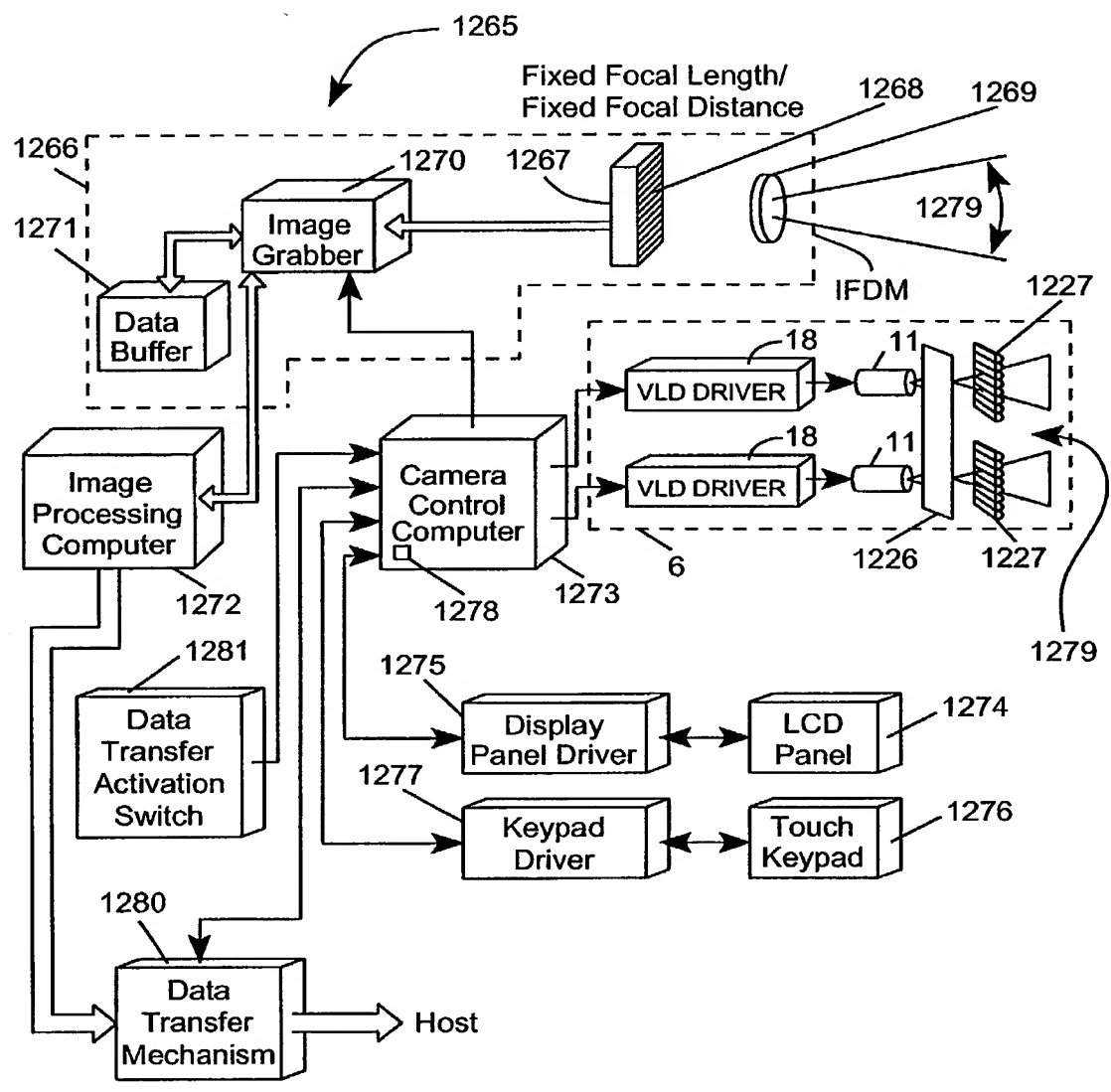
FIG. 40A1



Automatic with IR Object Detection

FIG. 40A2

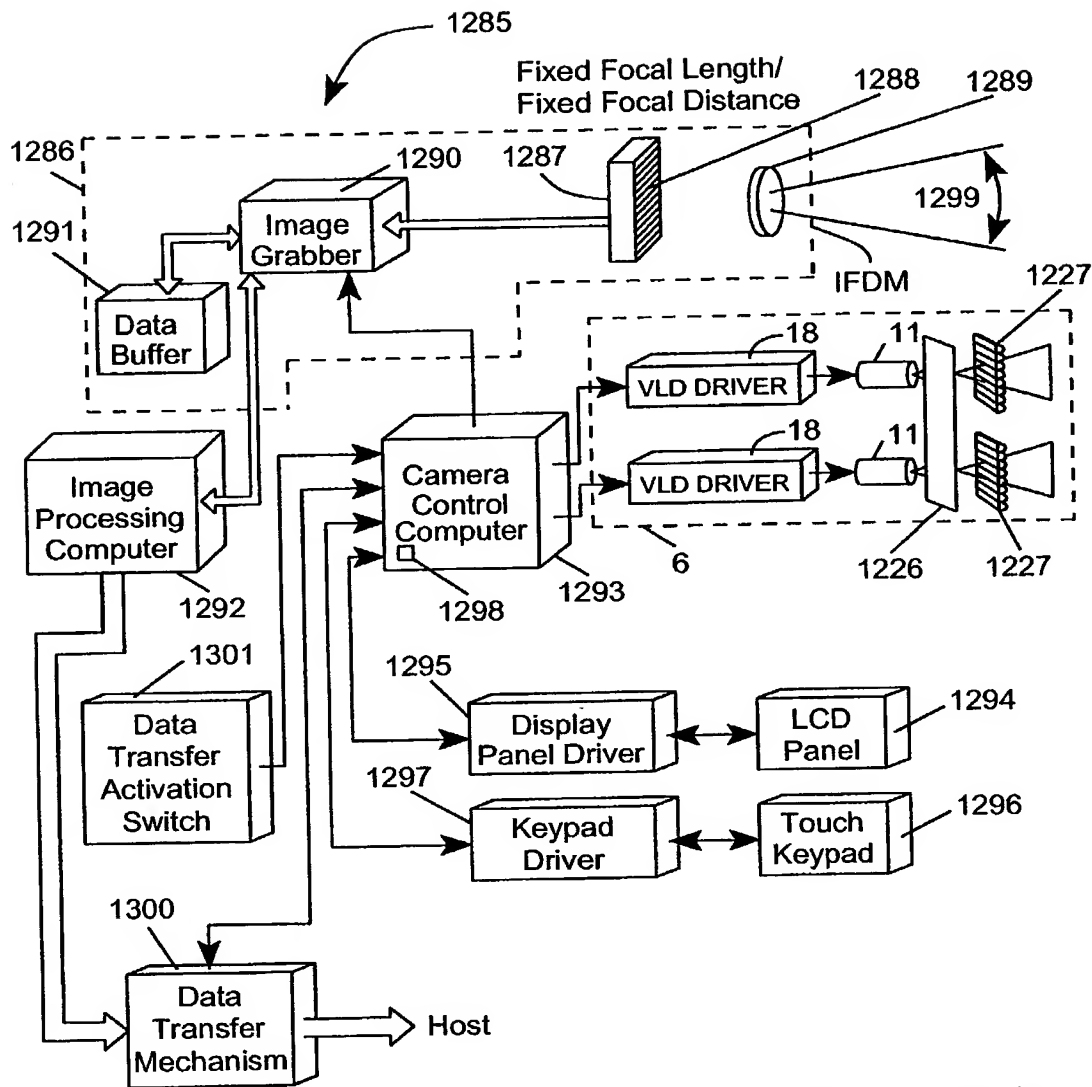
1/01



Automatic with Laser Based Object Detection

FIG. 40A3

7218



Automatic with Passive CCD  
Based Object Detection

FIG. 40A4

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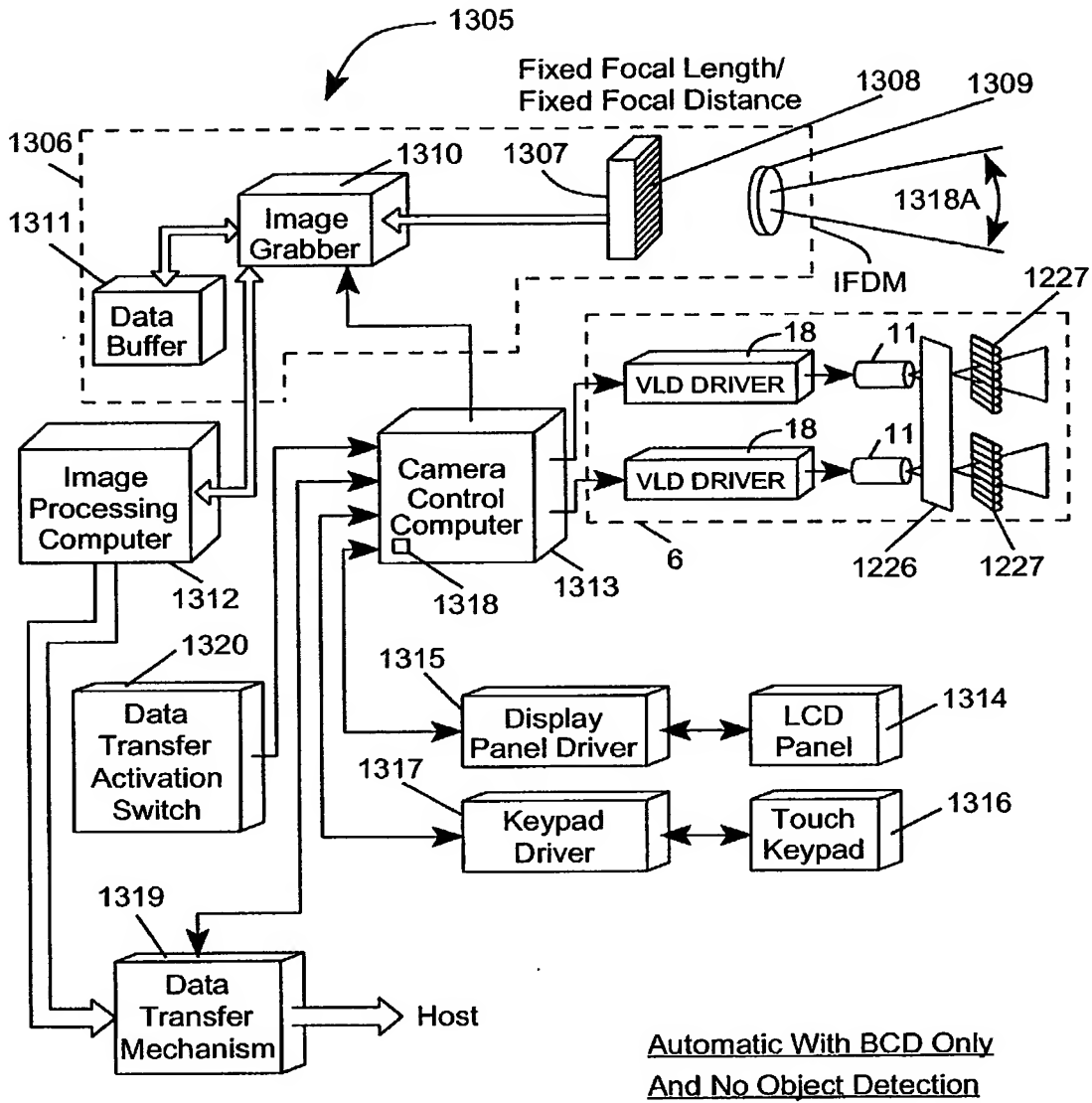
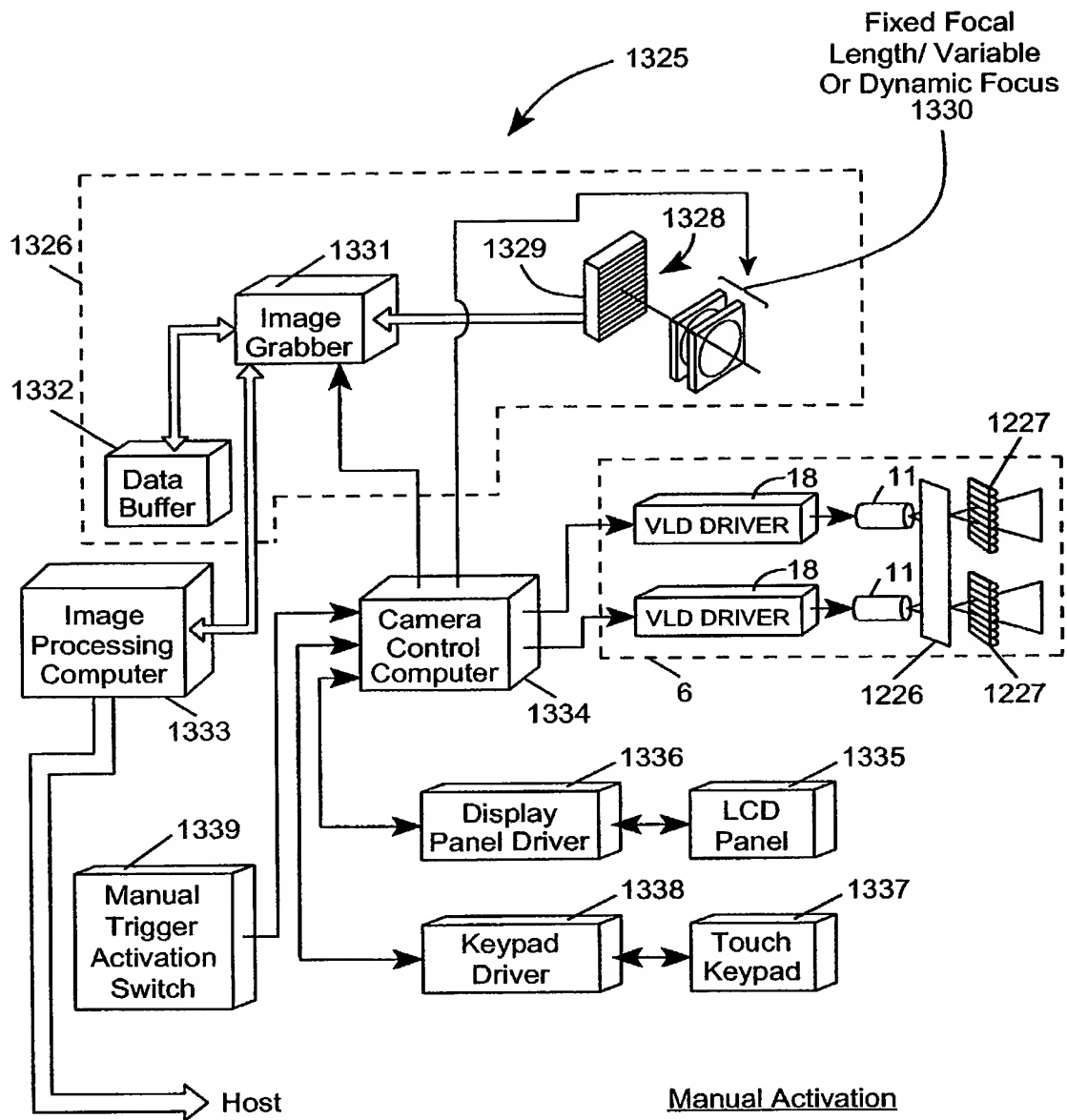


FIG. 40A5



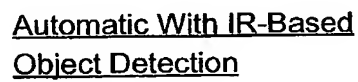


FIG. 40B2





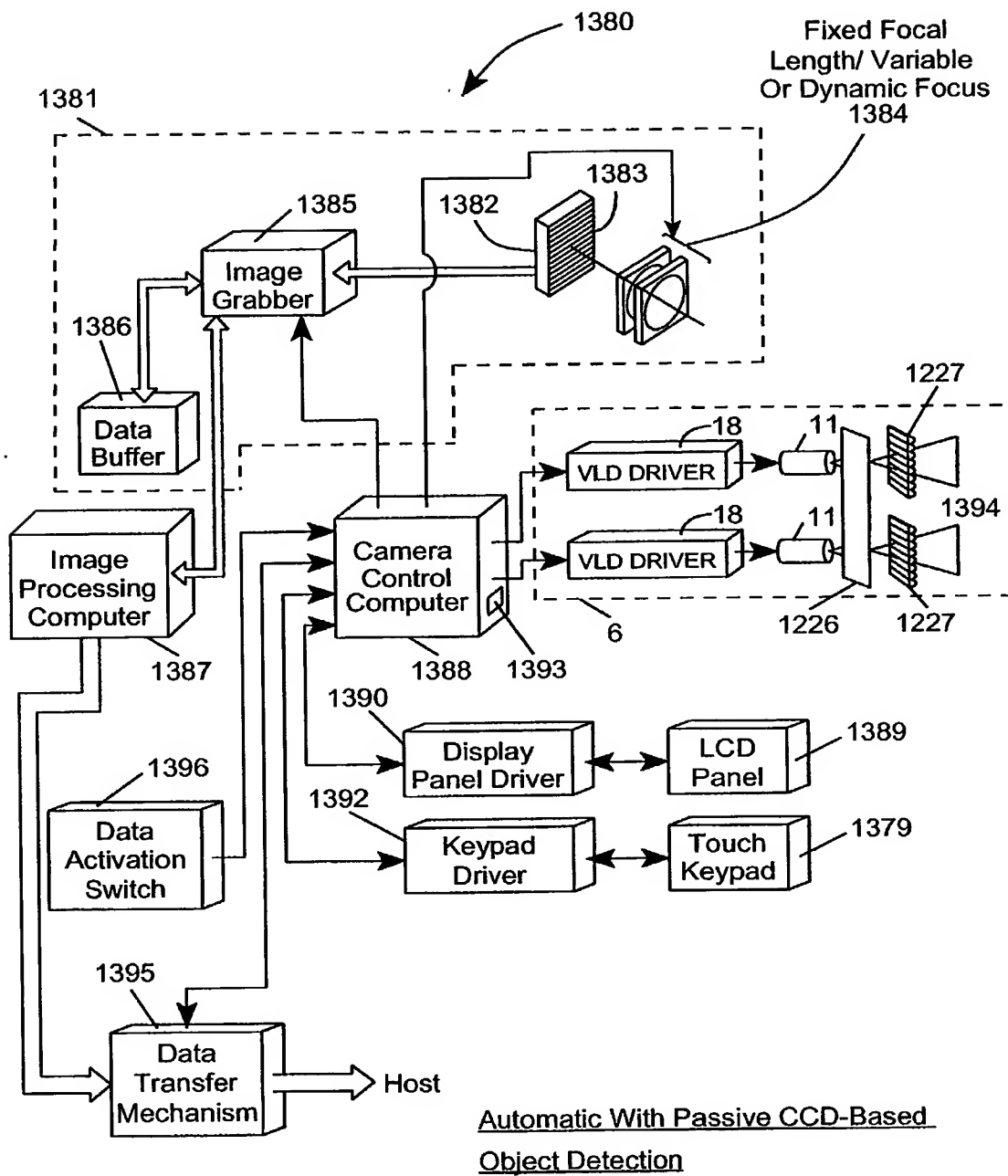


FIG. 40B4

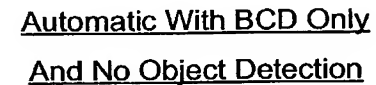


FIG. 40B5

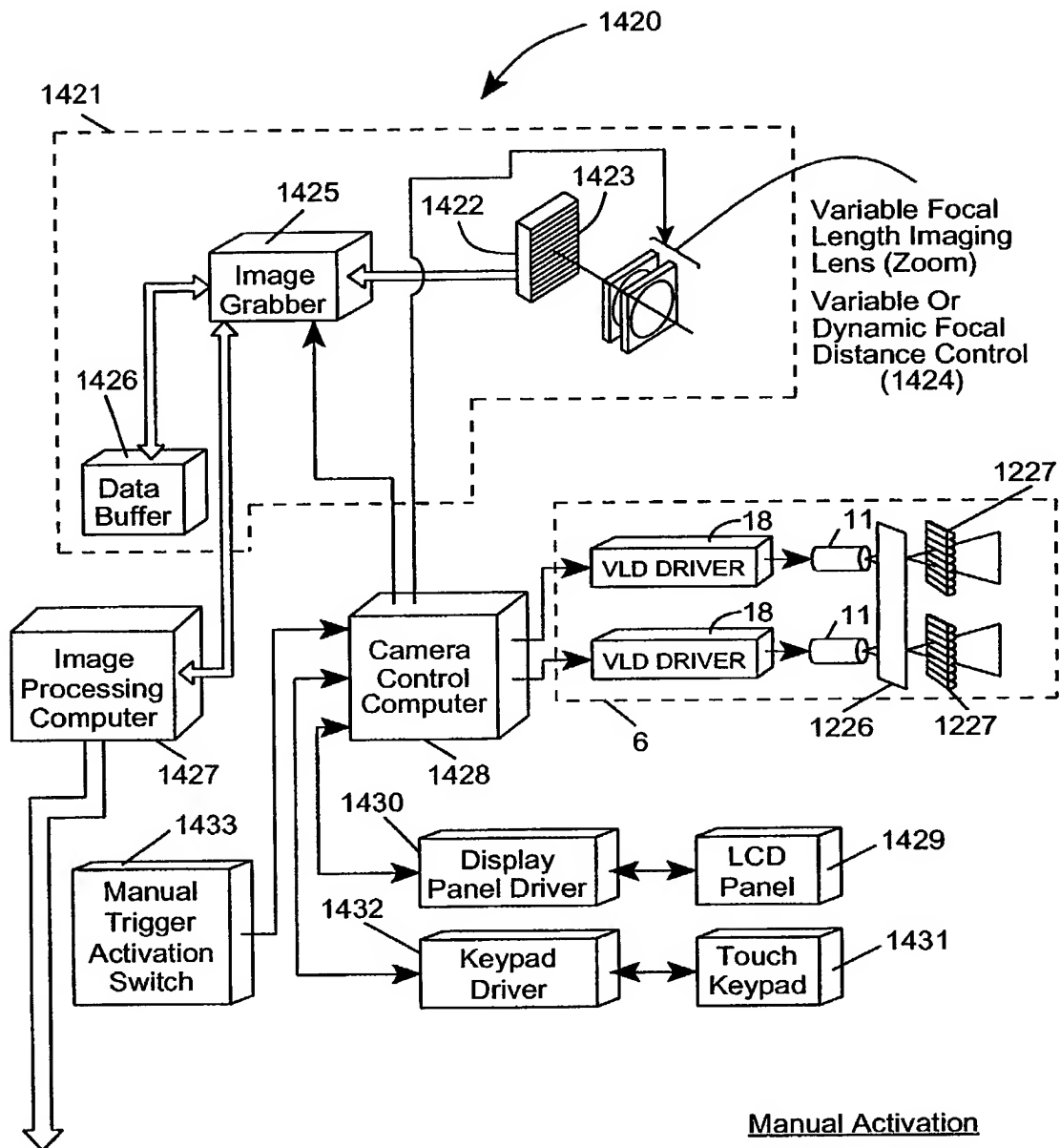


FIG. 40C1



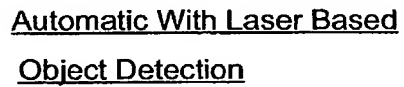


FIG. 40C3

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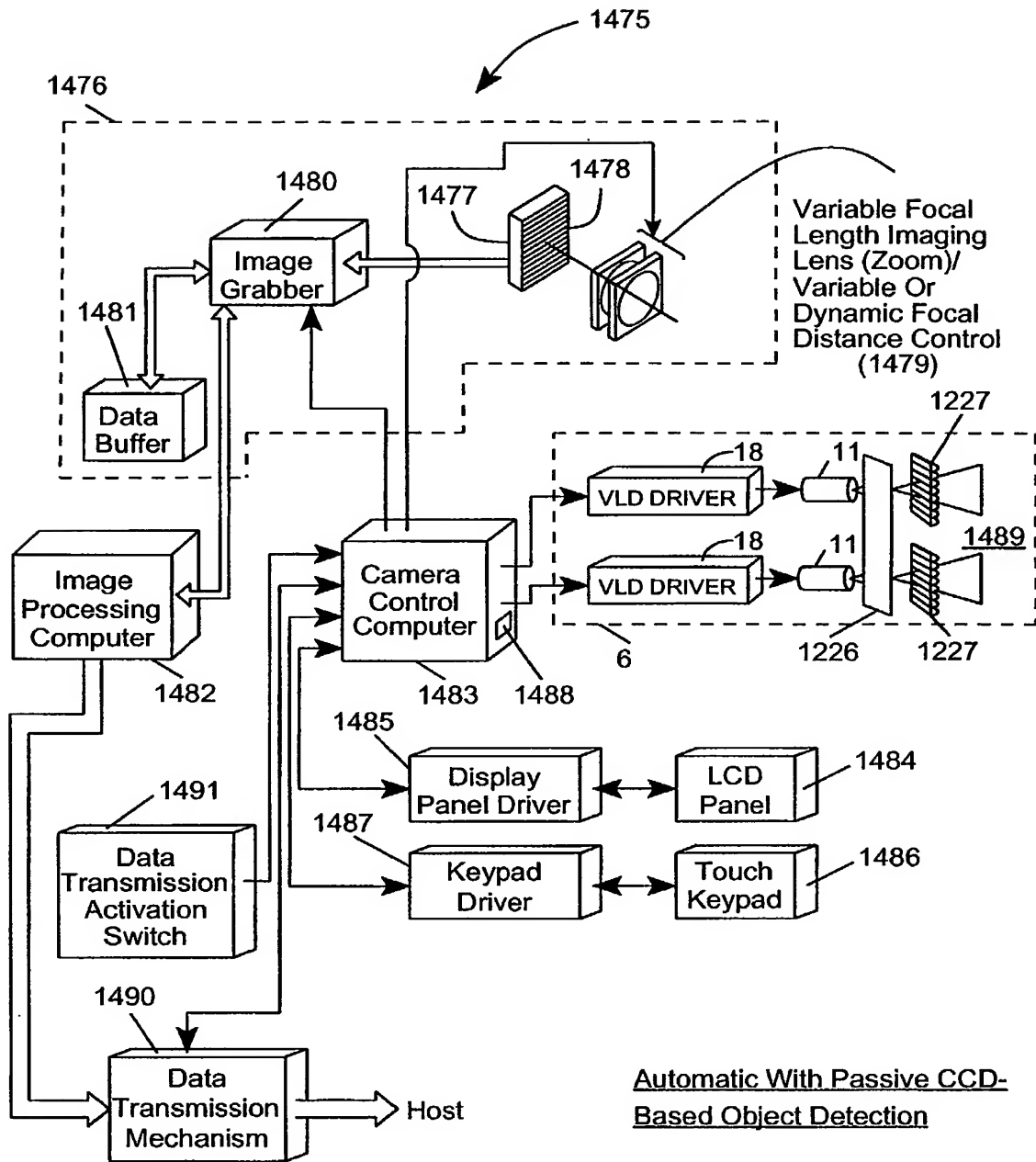


FIG. 40C4

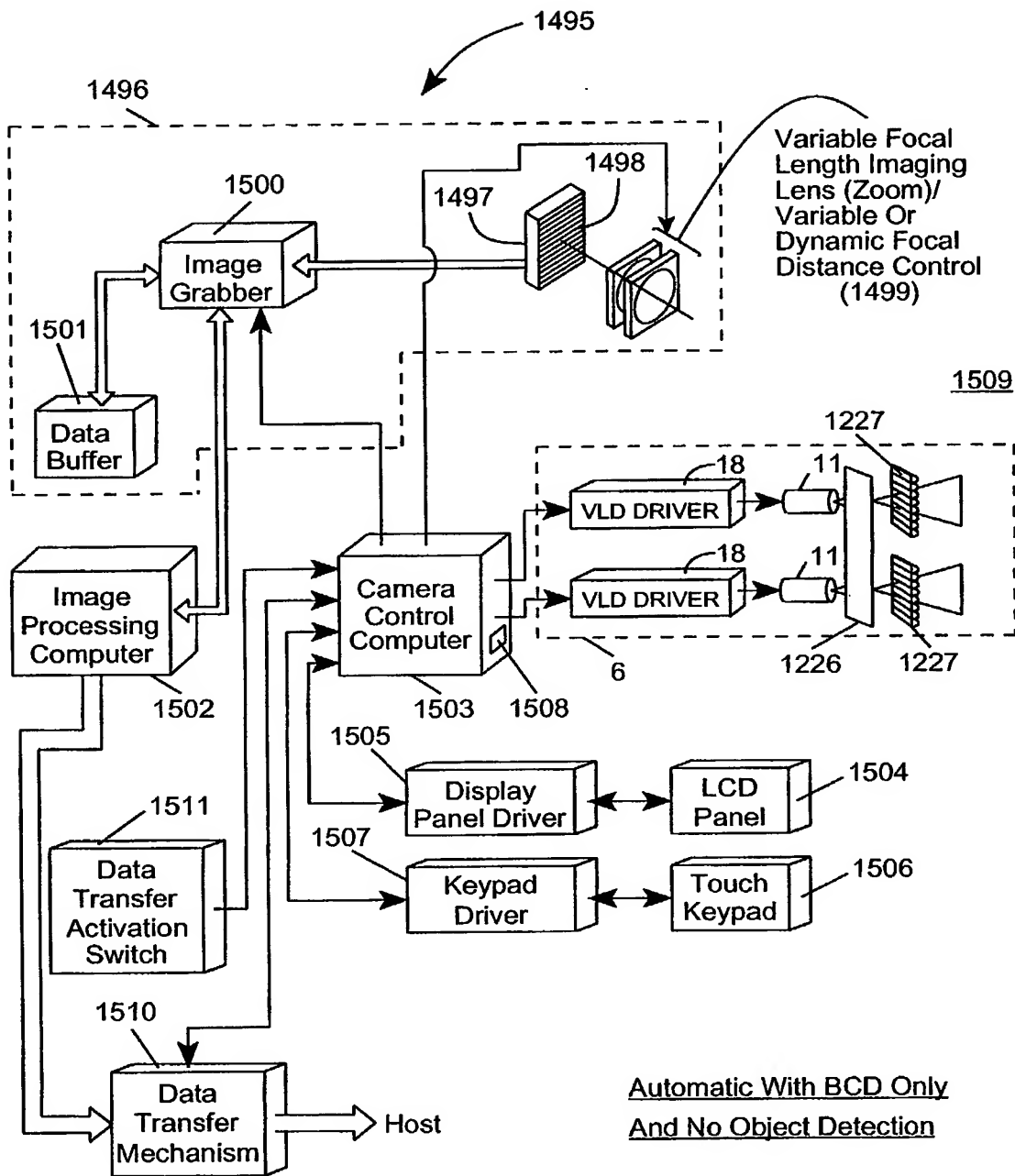


FIG. 40C5

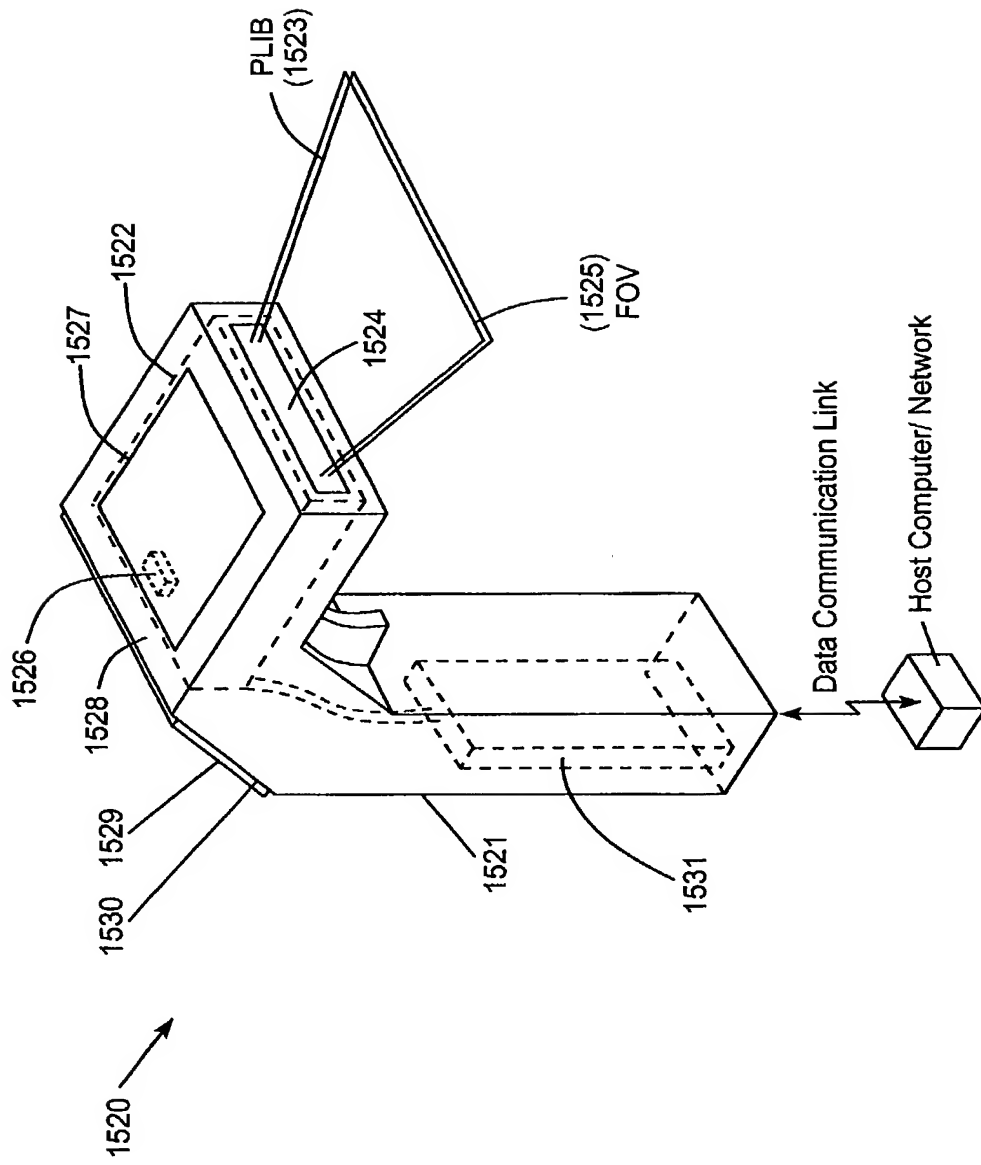
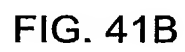


FIG. 41A





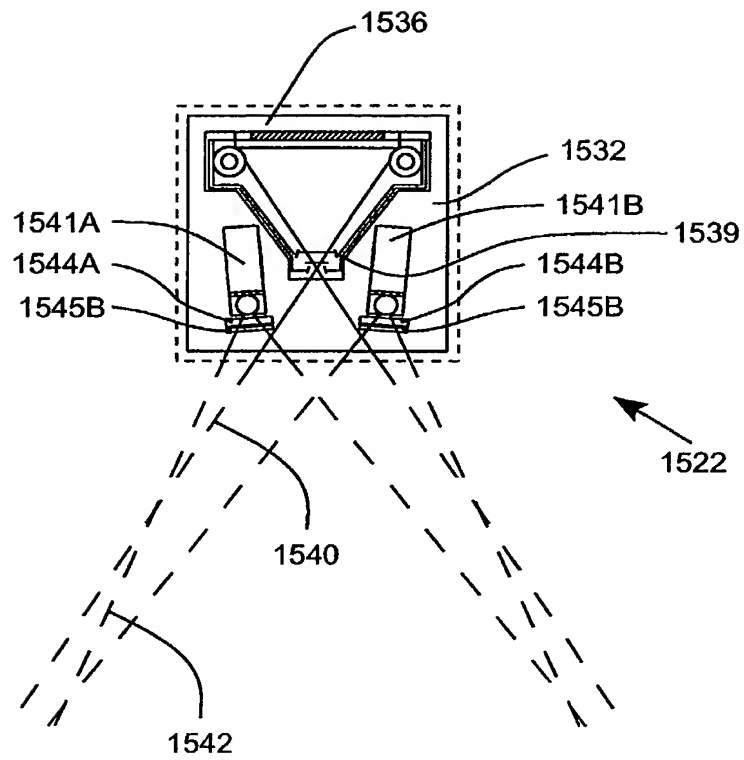


FIG. 41C

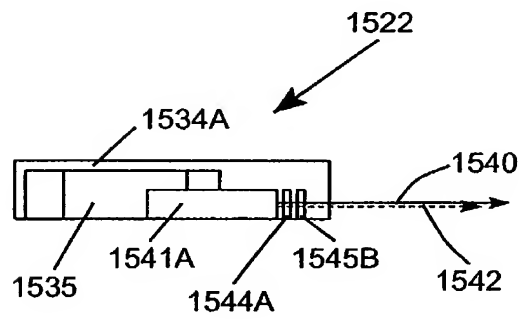


FIG. 41D

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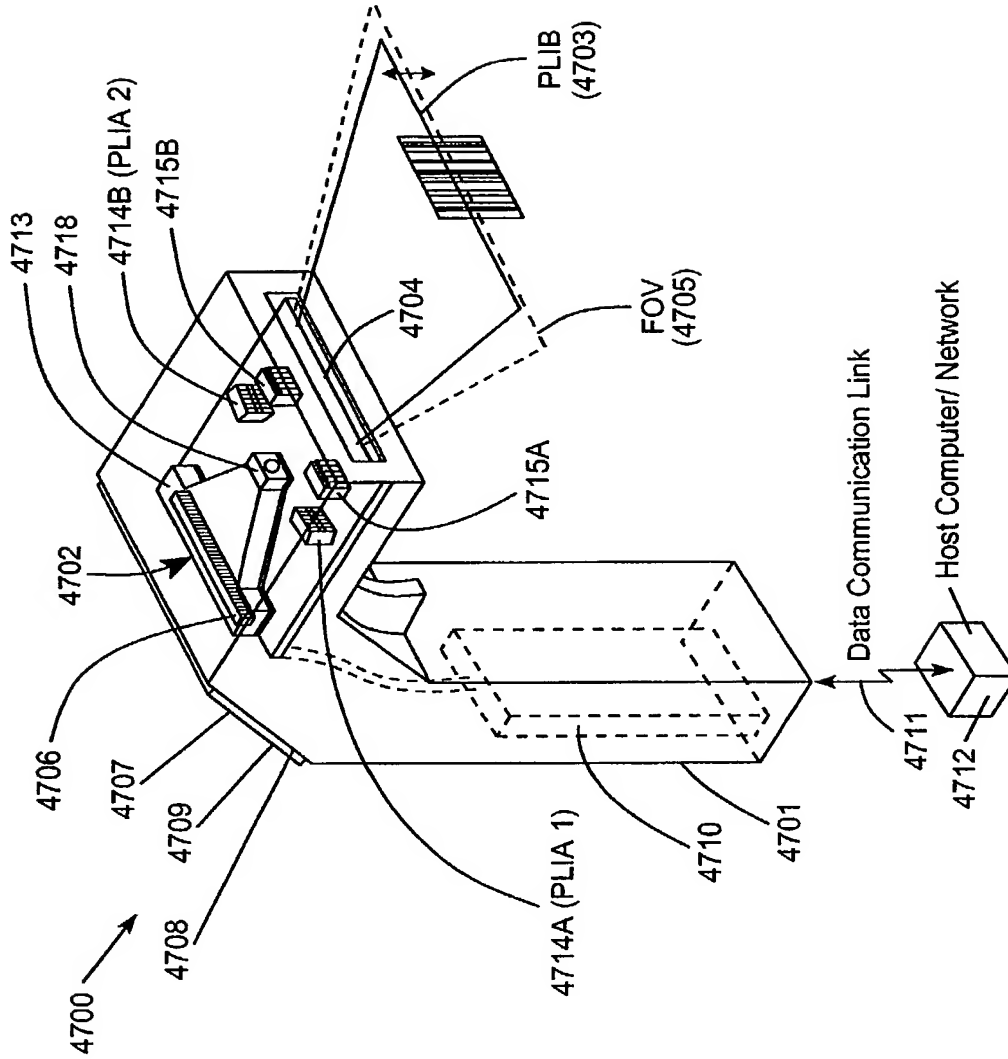


FIG. 42

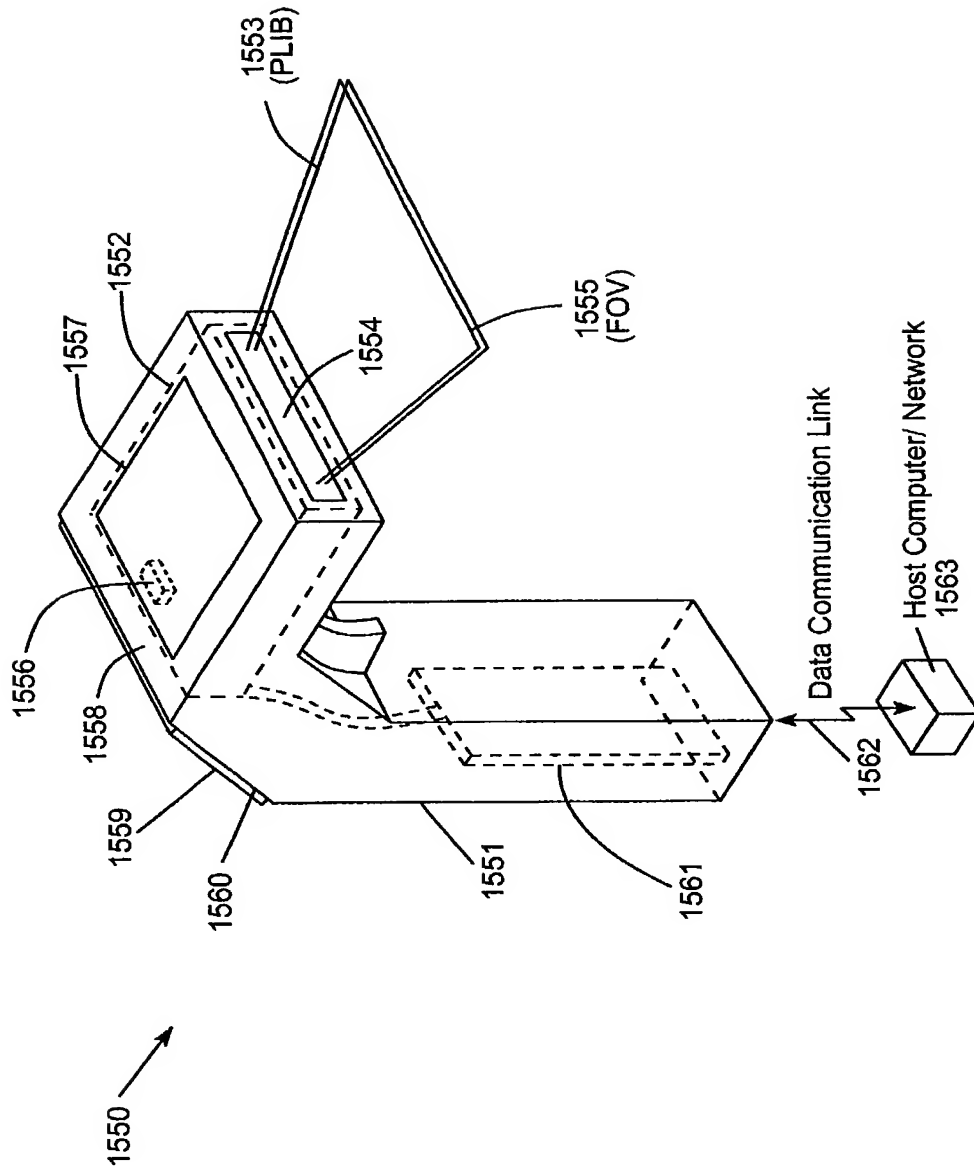


FIG. 42A

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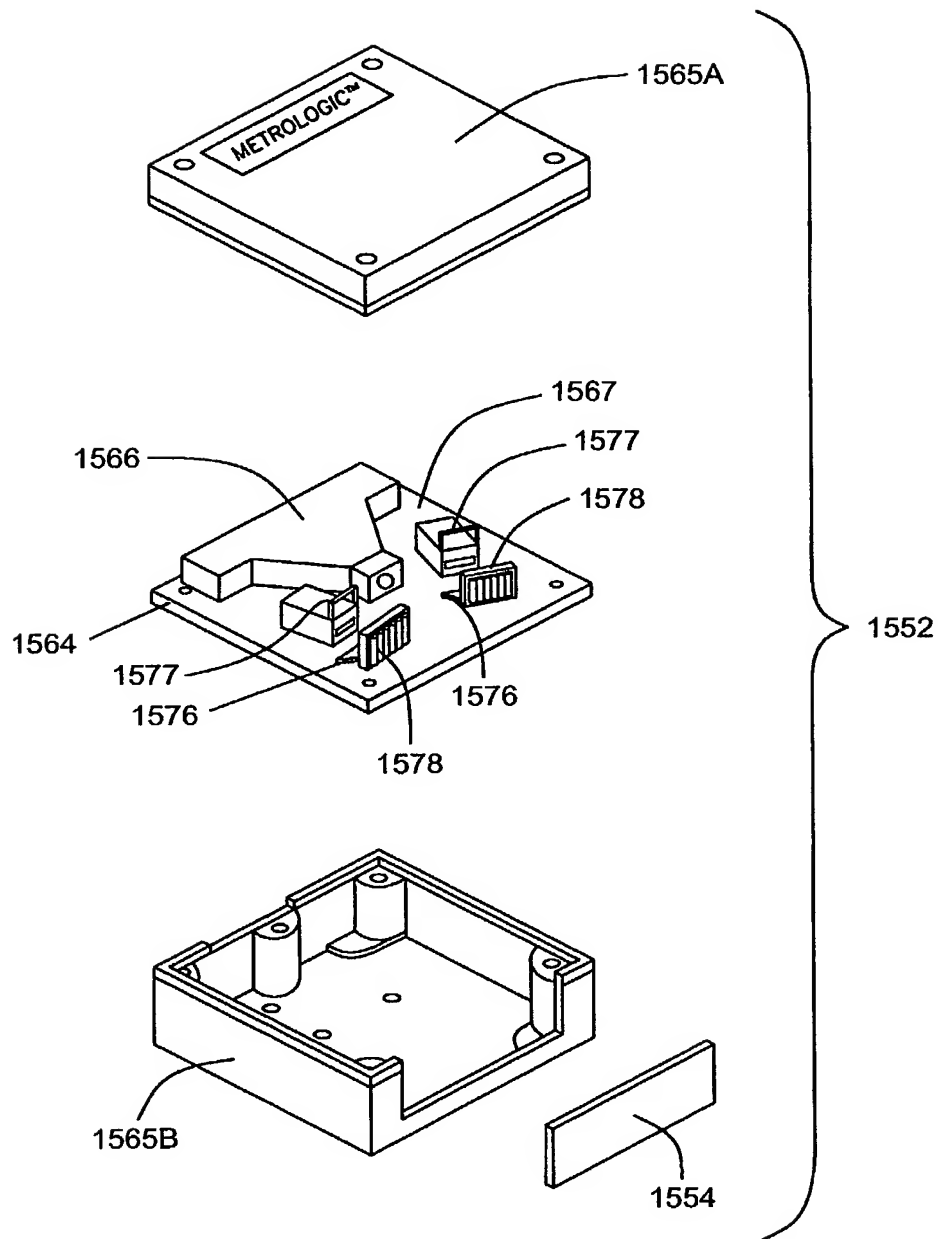


FIG. 42B

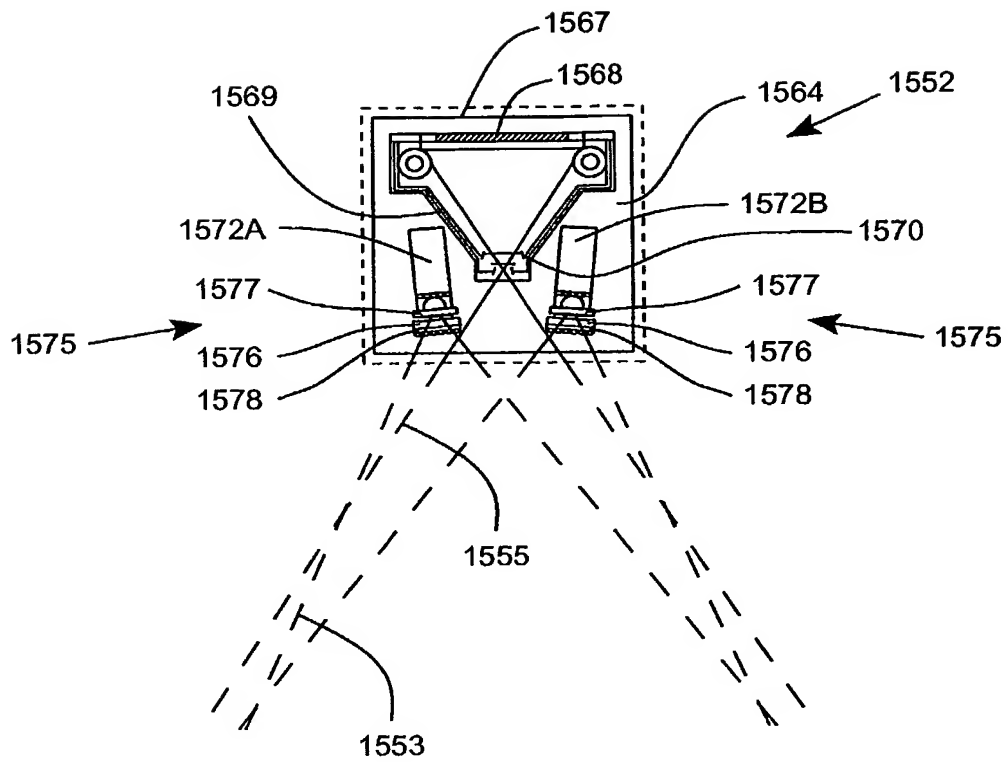


FIG. 42C

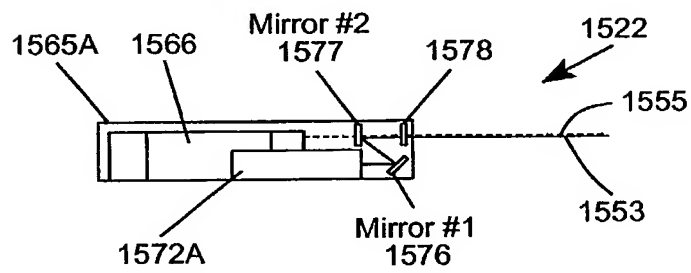


FIG. 42D

FIG. 1

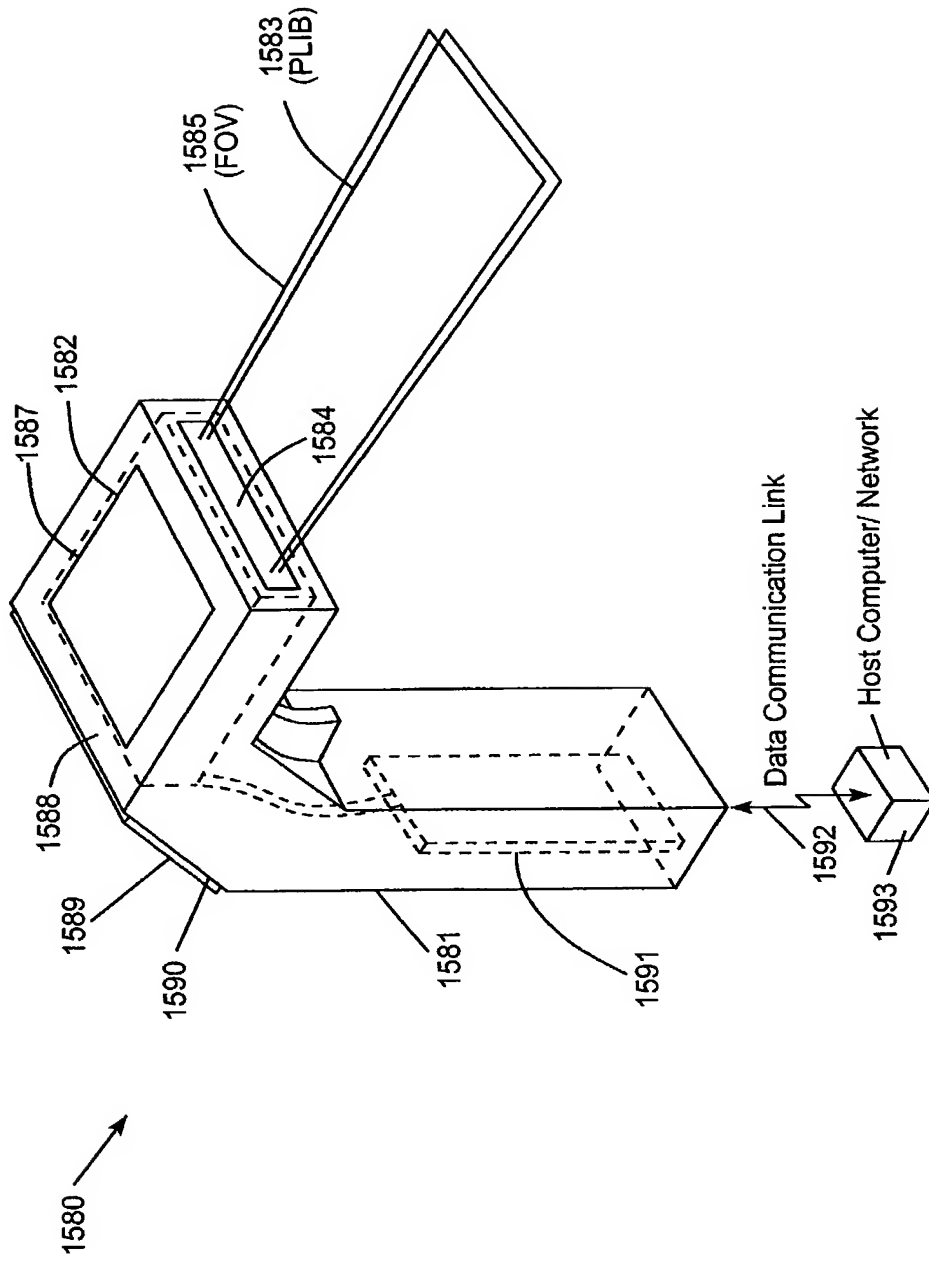
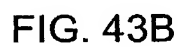


FIG. 43A





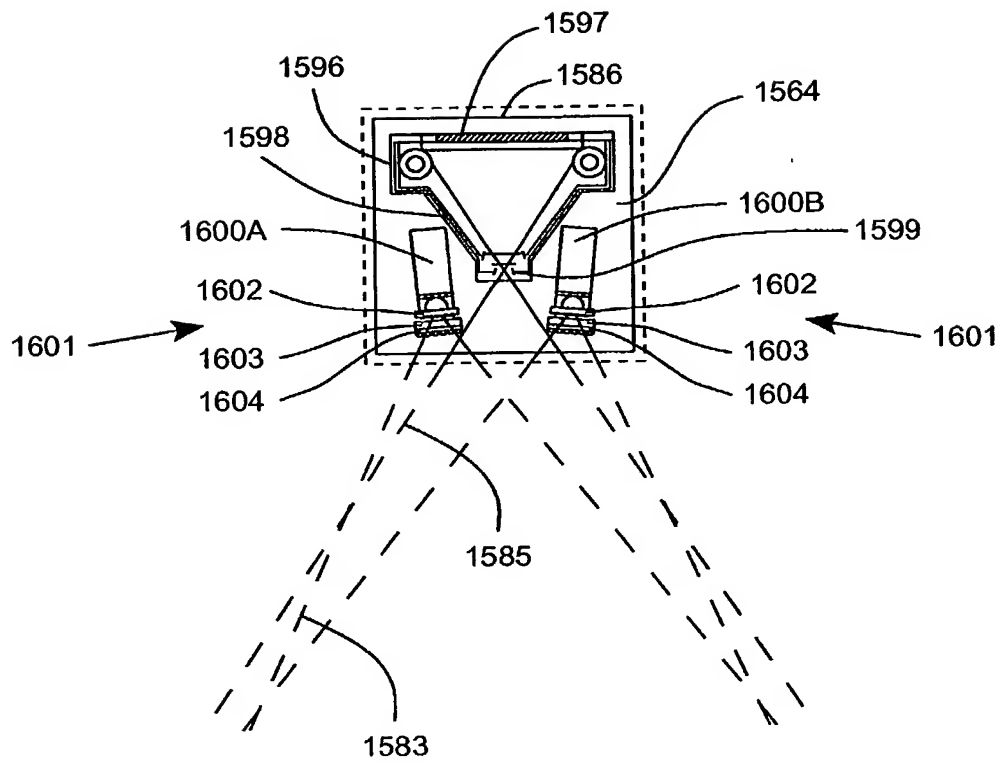


FIG. 43C

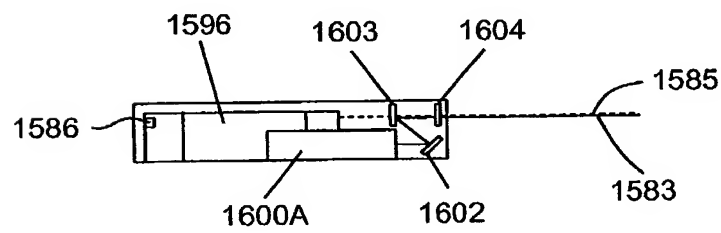


FIG. 43D

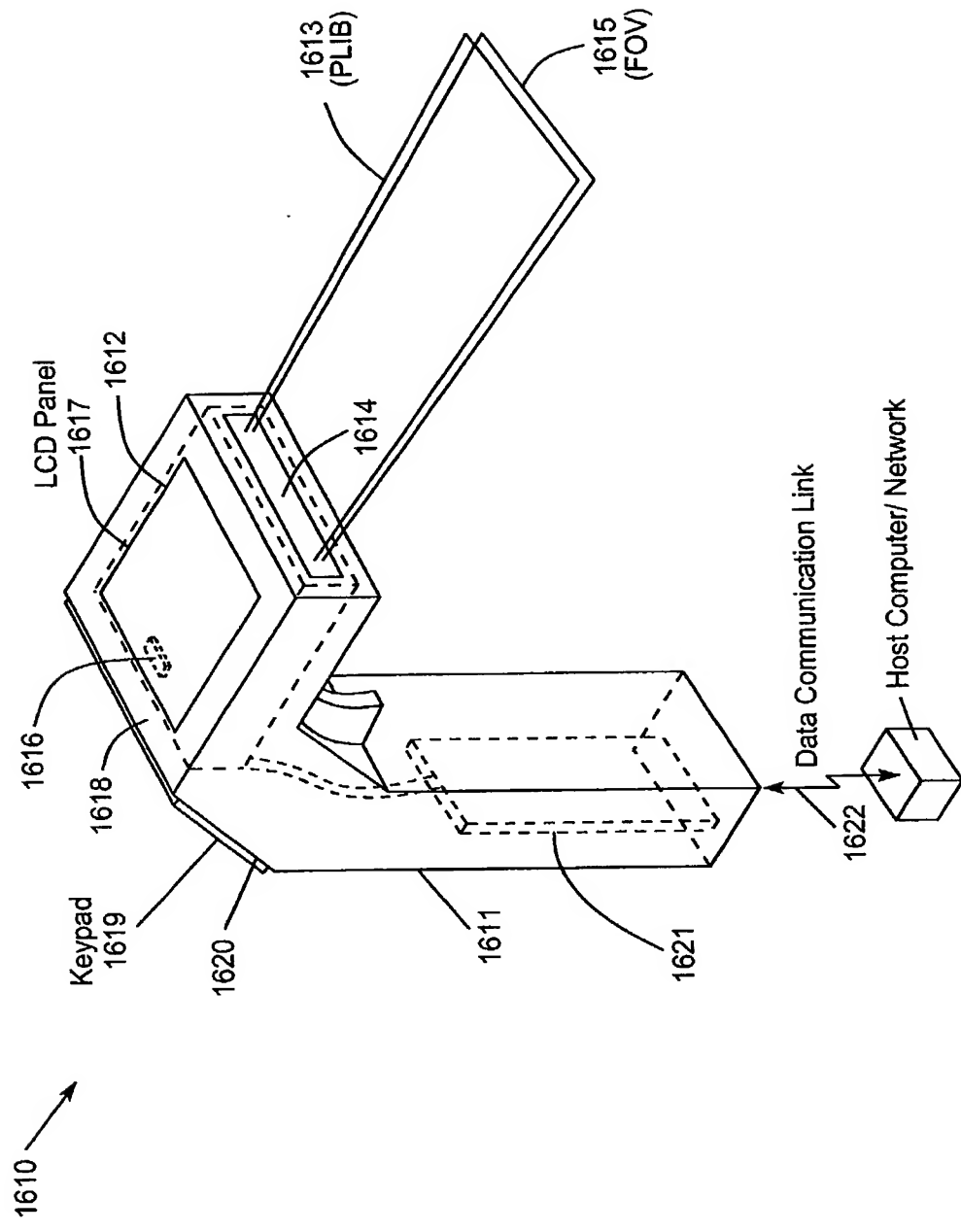


FIG. 44A

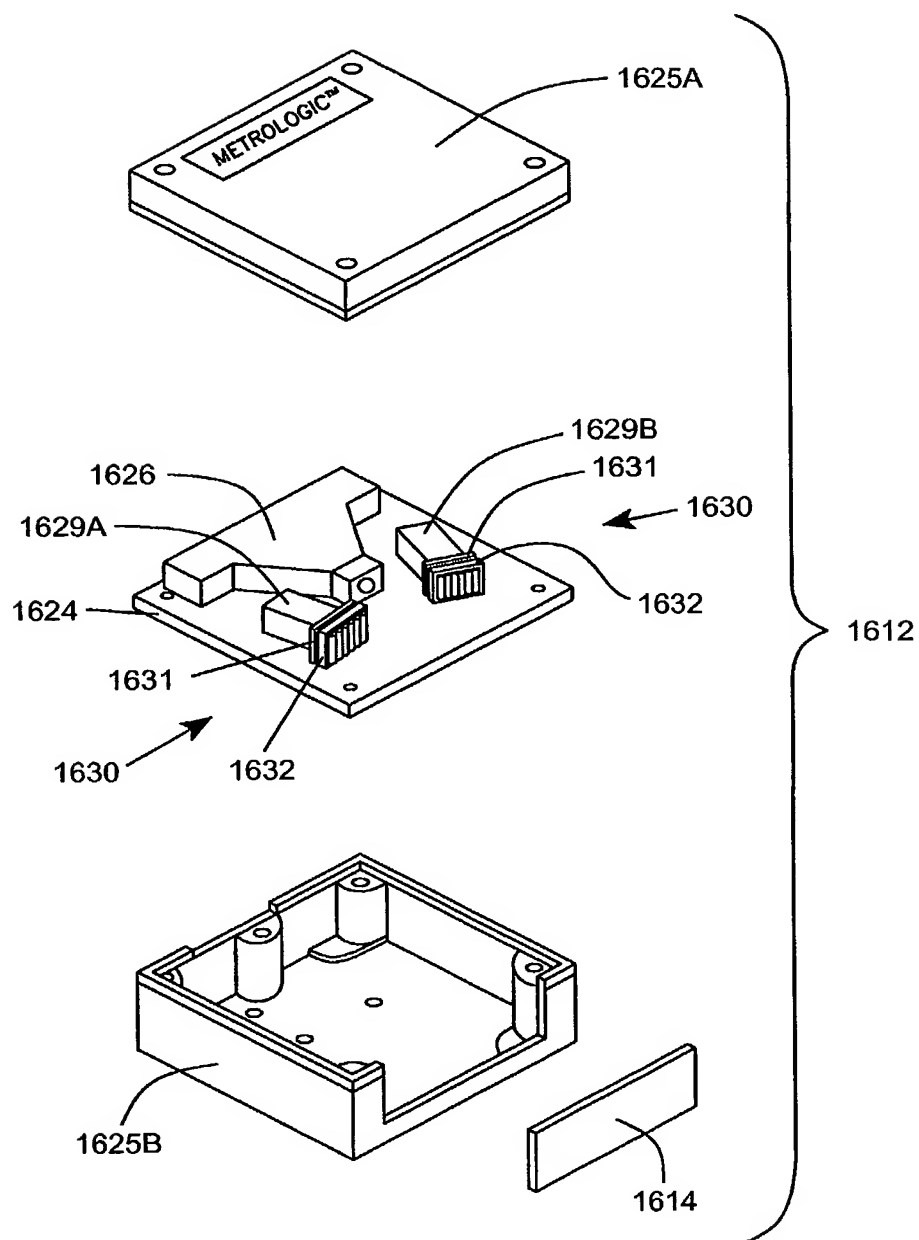


FIG. 44B

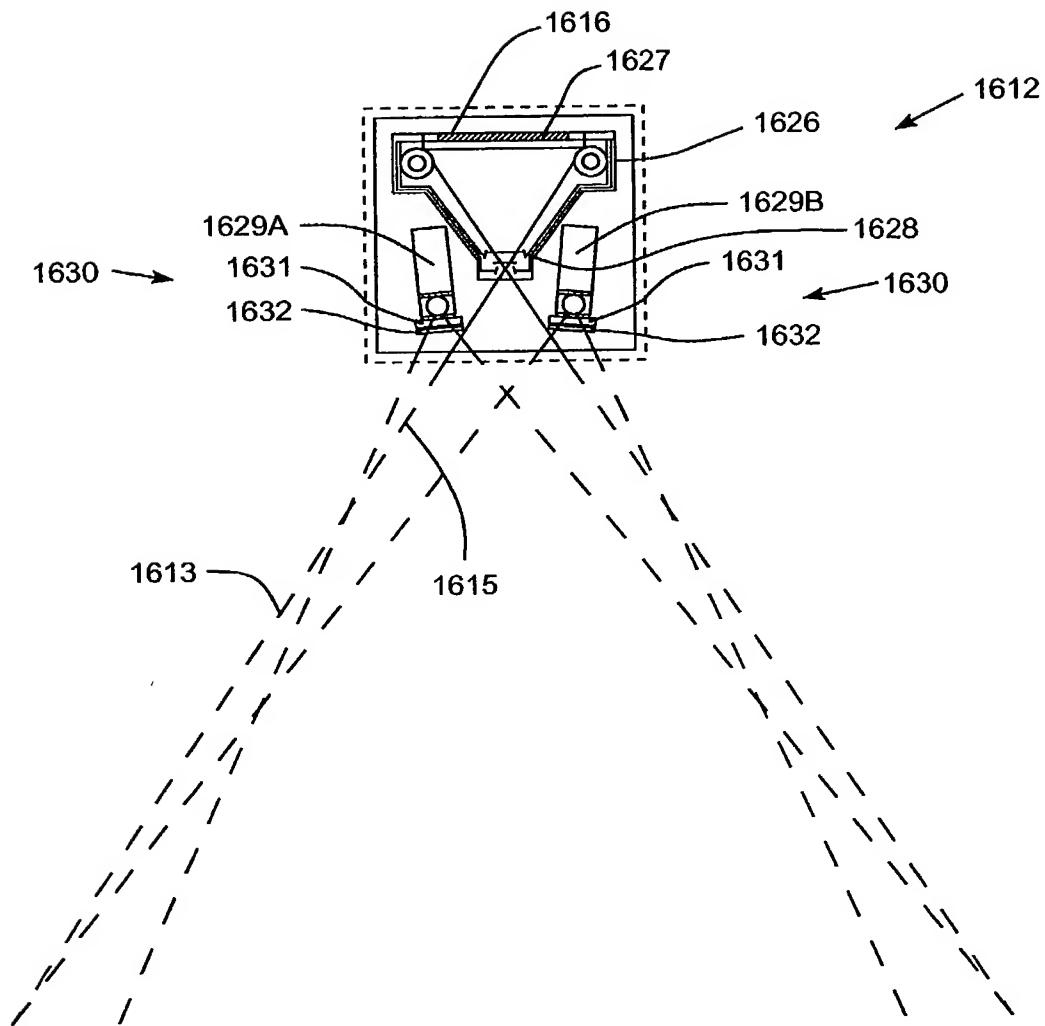


FIG. 44C

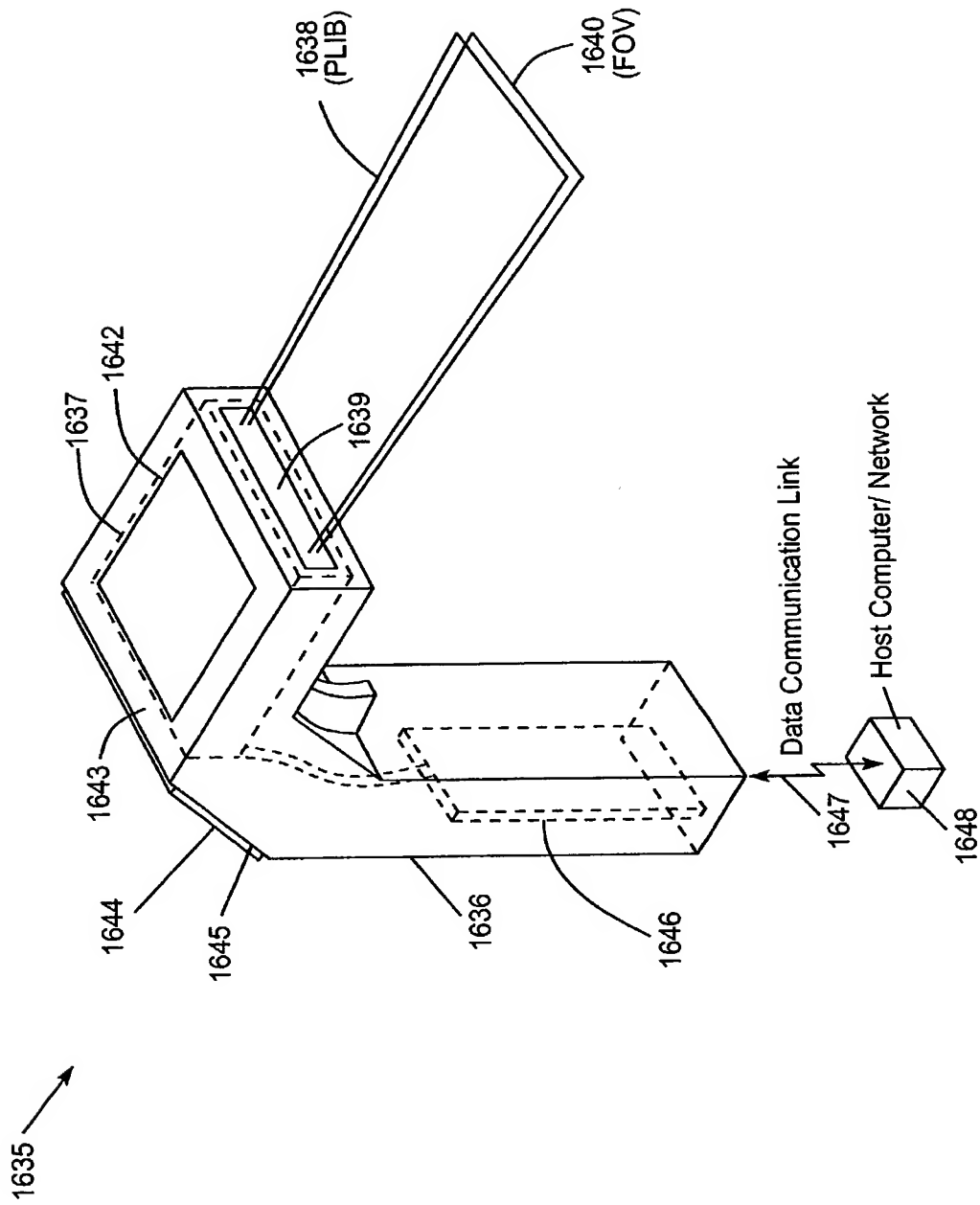


FIG. 45A

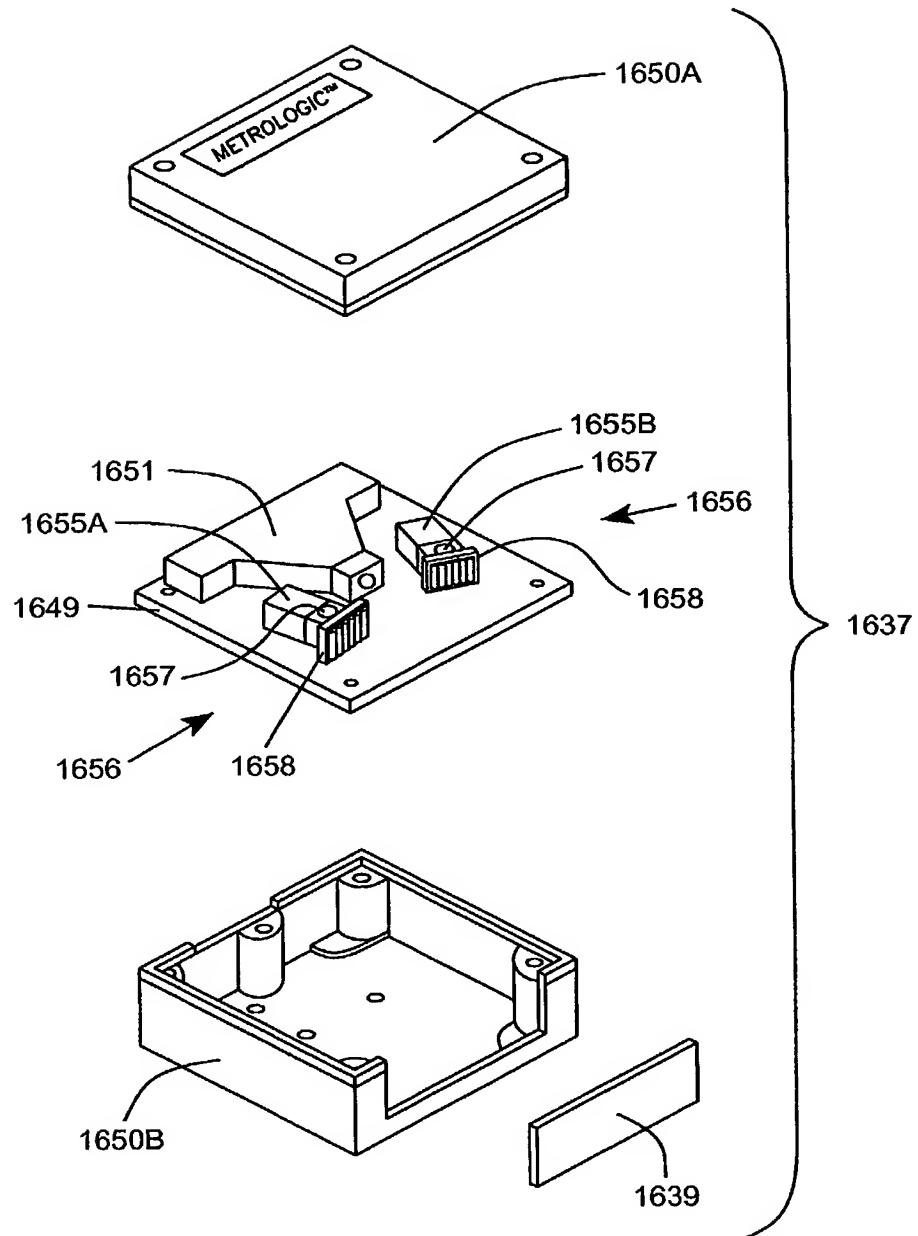


FIG. 45B

FIG. 45C

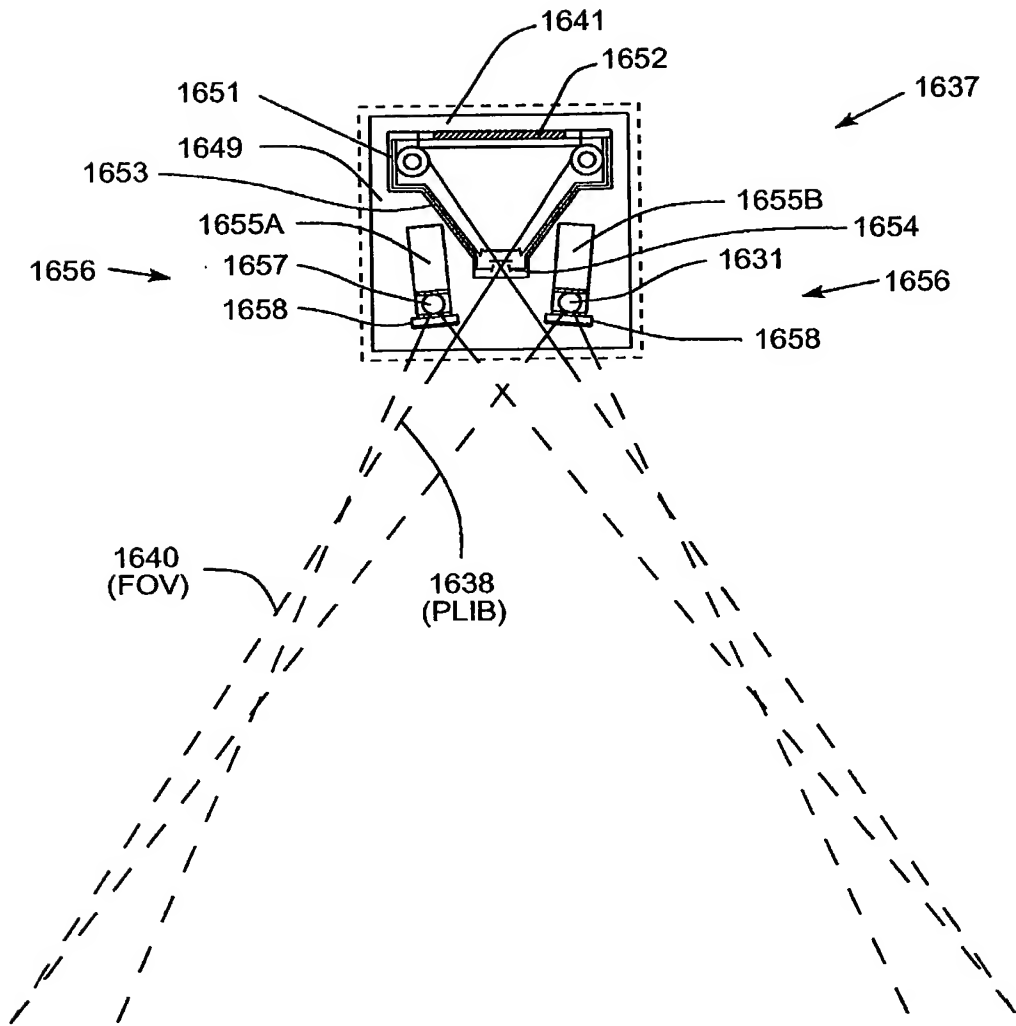


FIG. 45C

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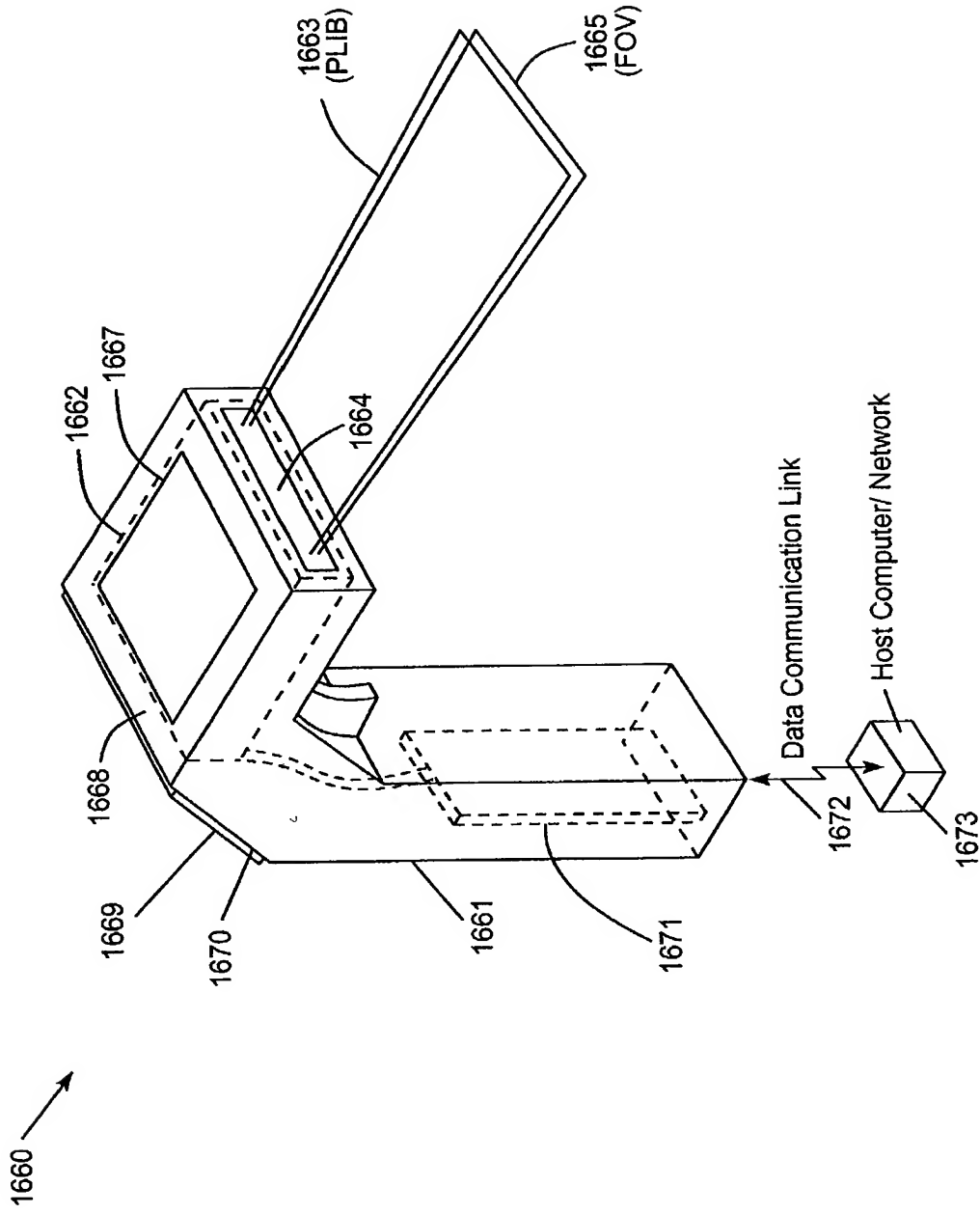


FIG. 46A



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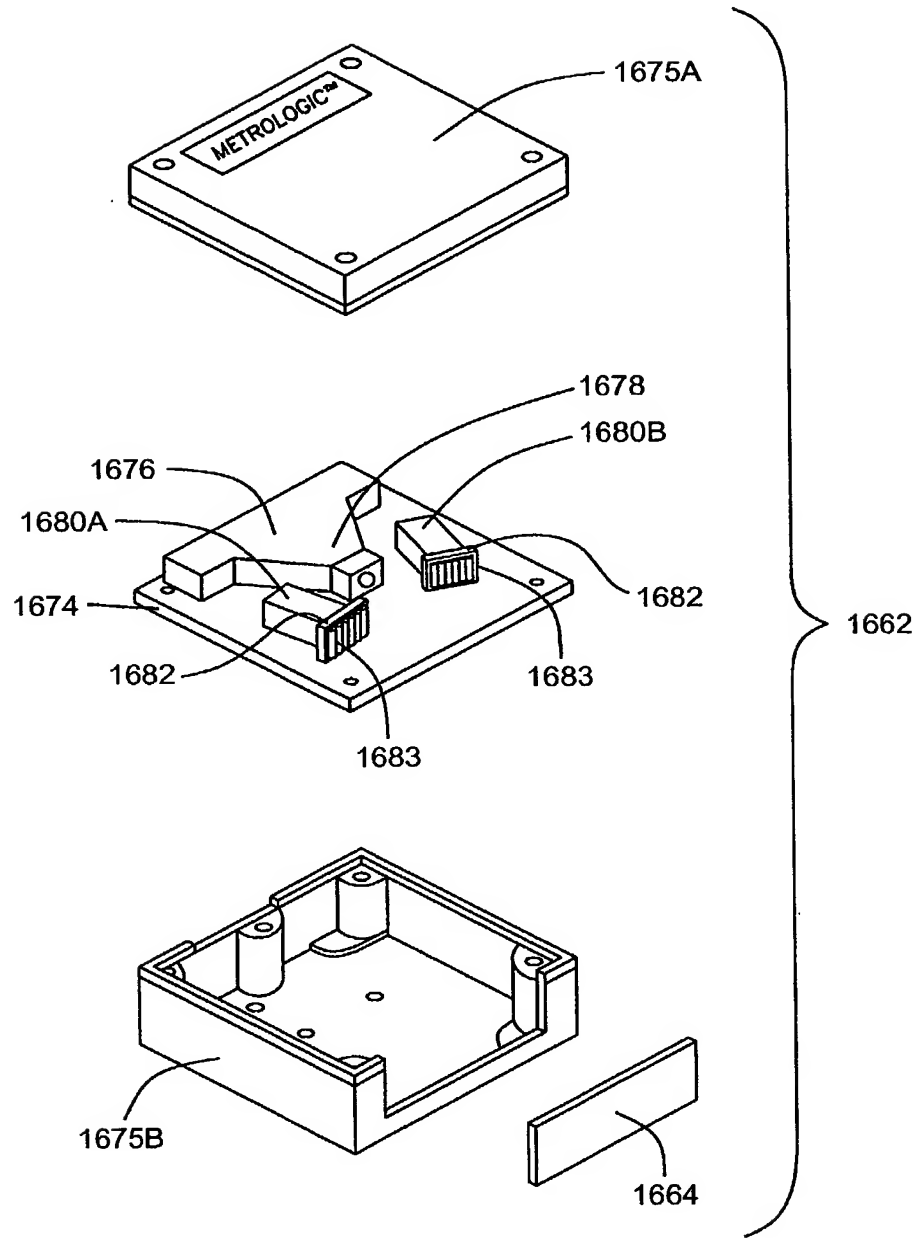


FIG. 46B



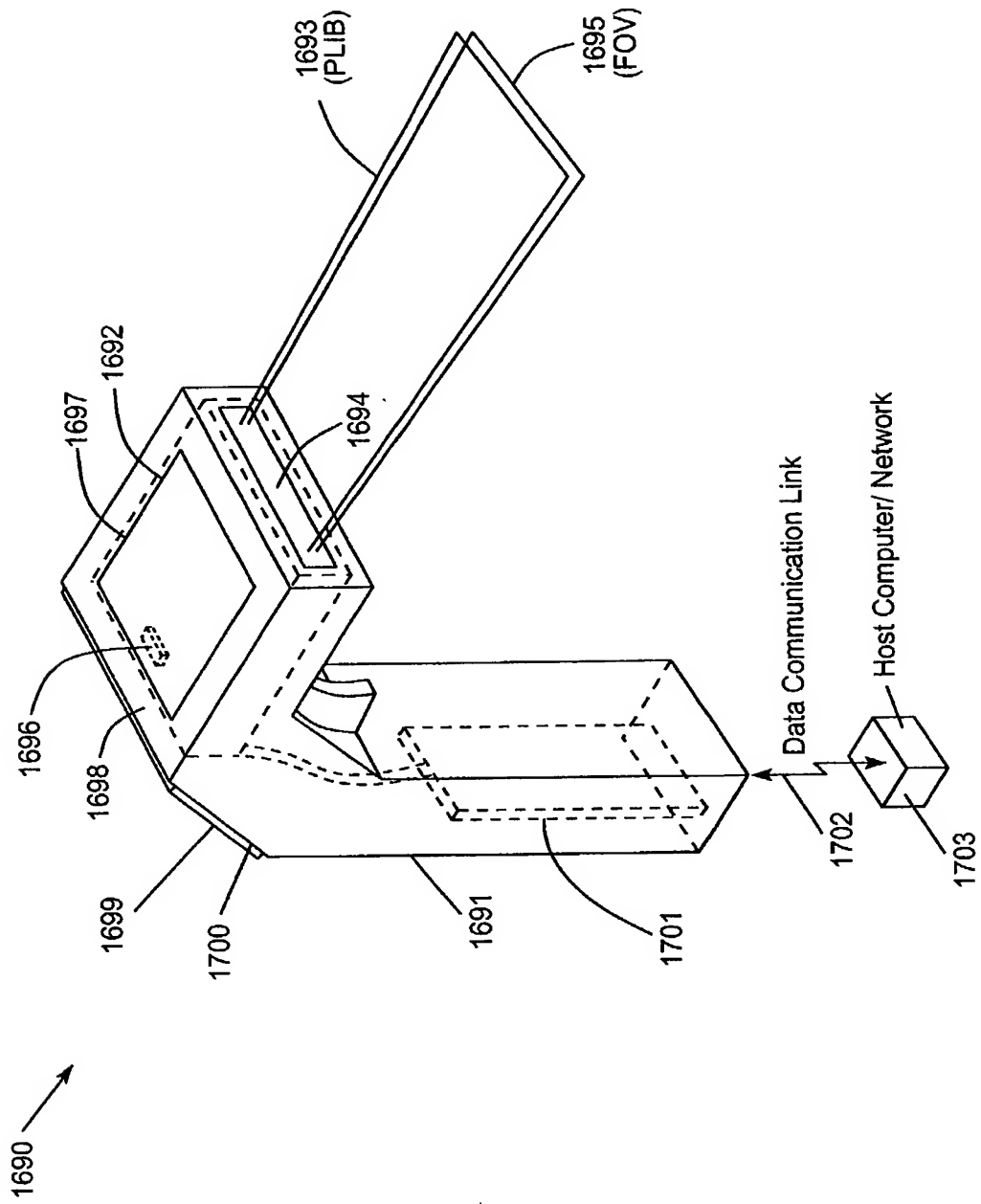


FIG. 47A

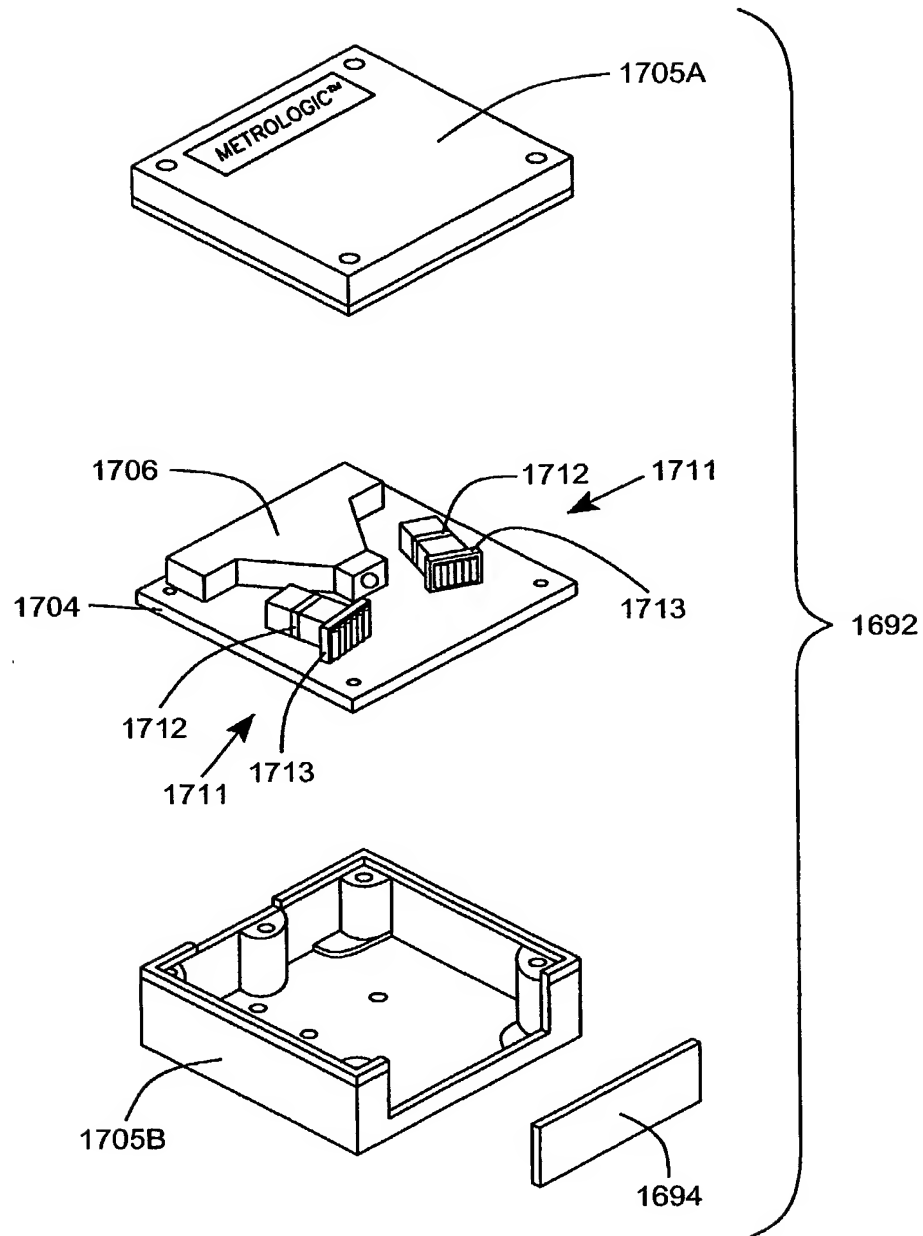


FIG. 47B



FIG. 48A

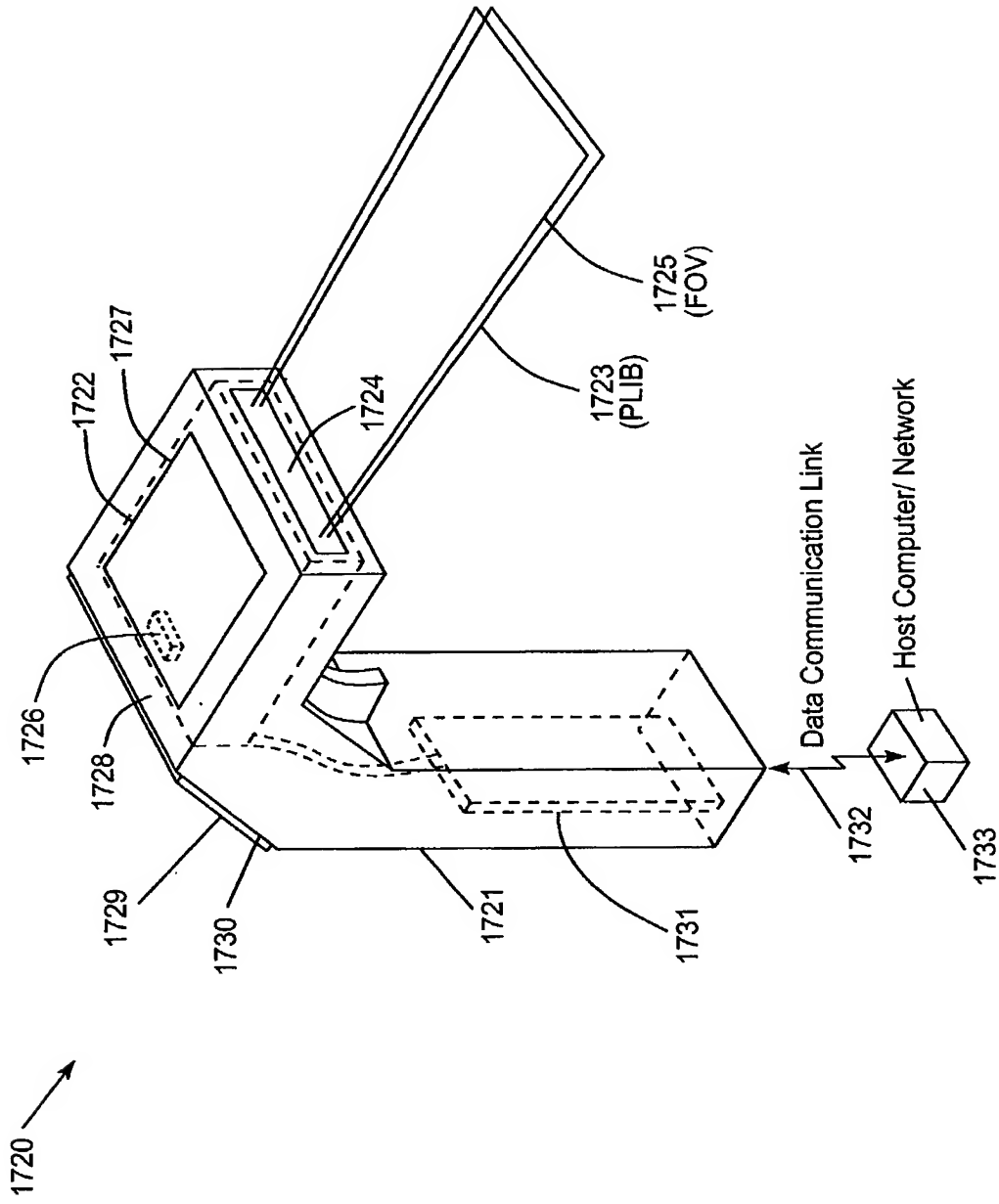


FIG. 48A

FIG. 48A

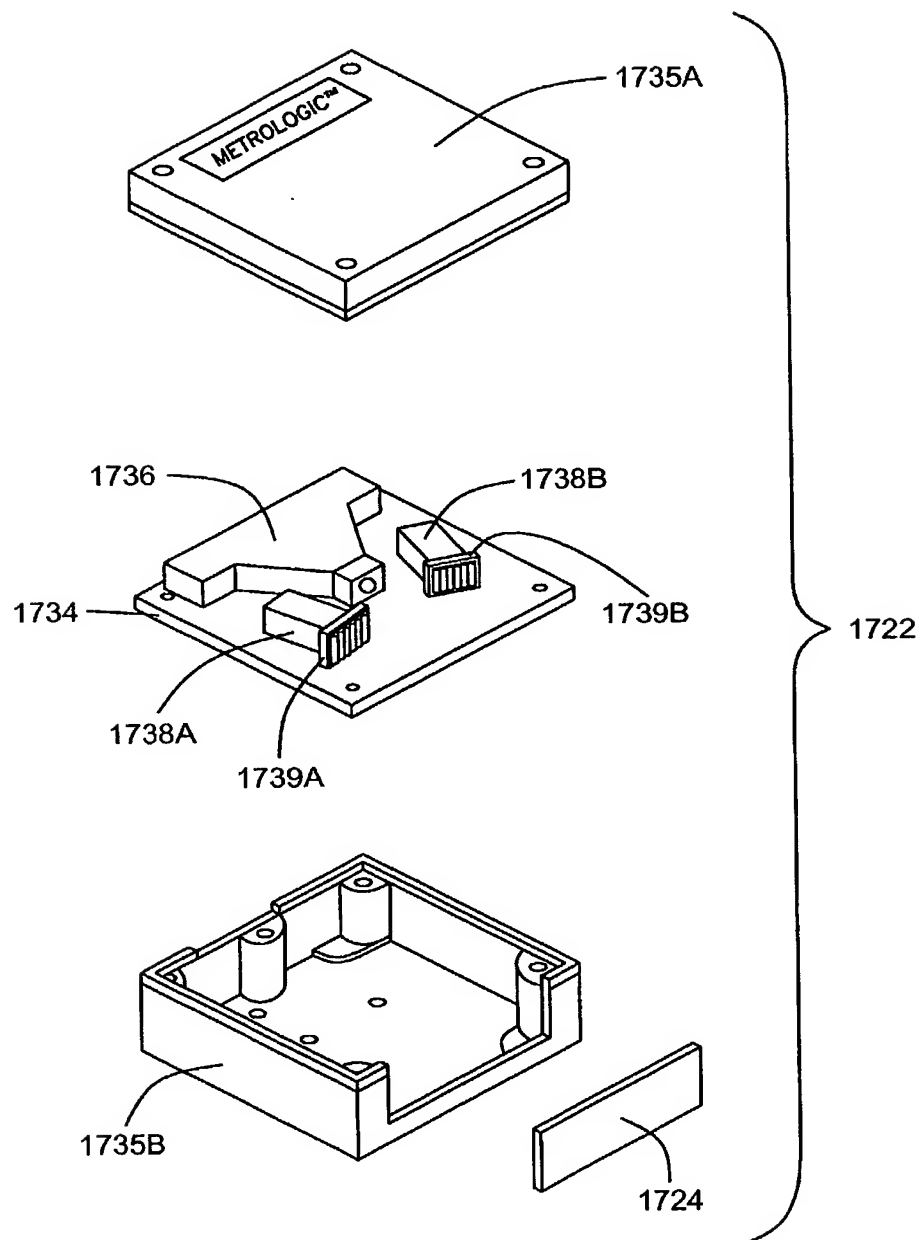
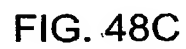


FIG. 48B







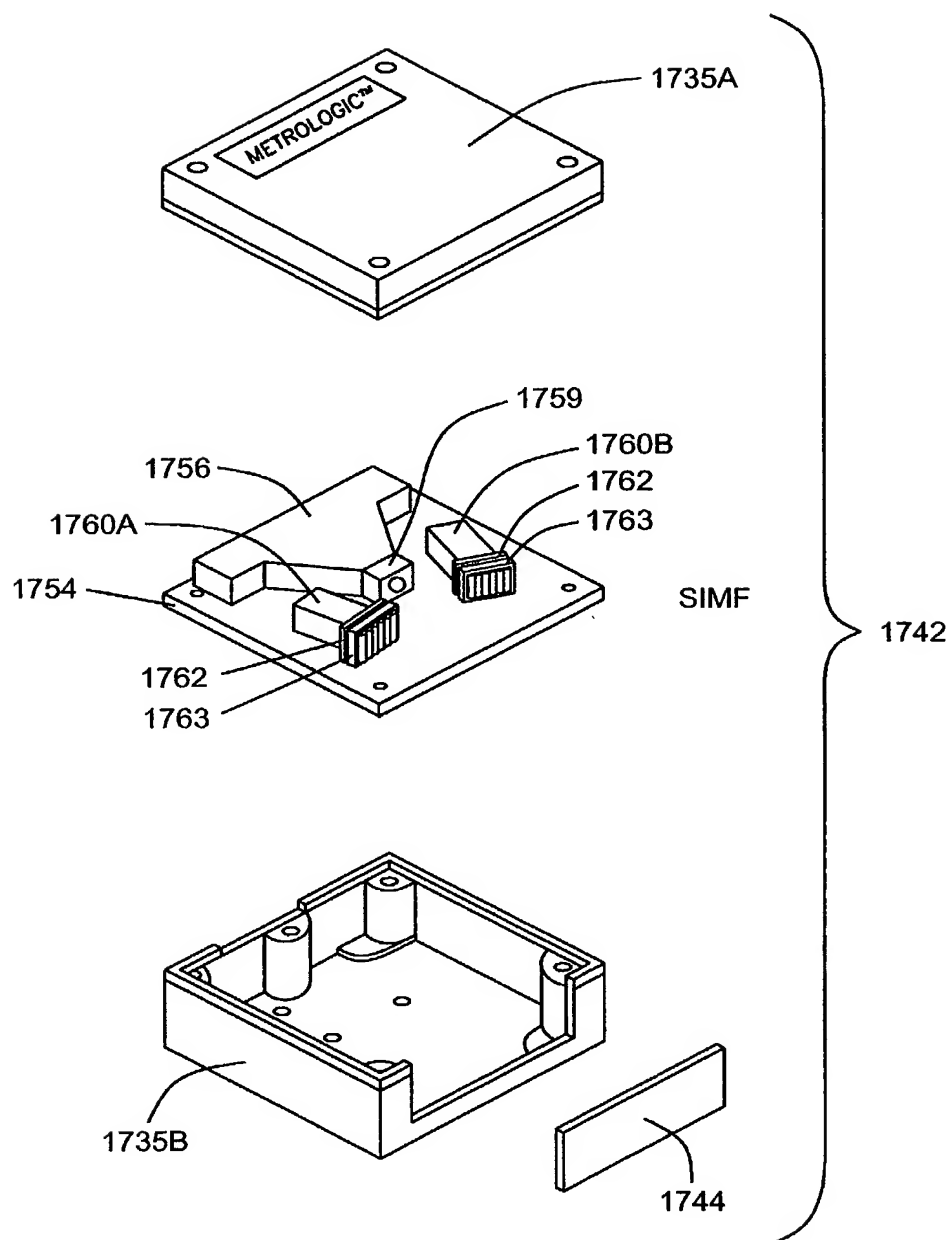


FIG. 49B

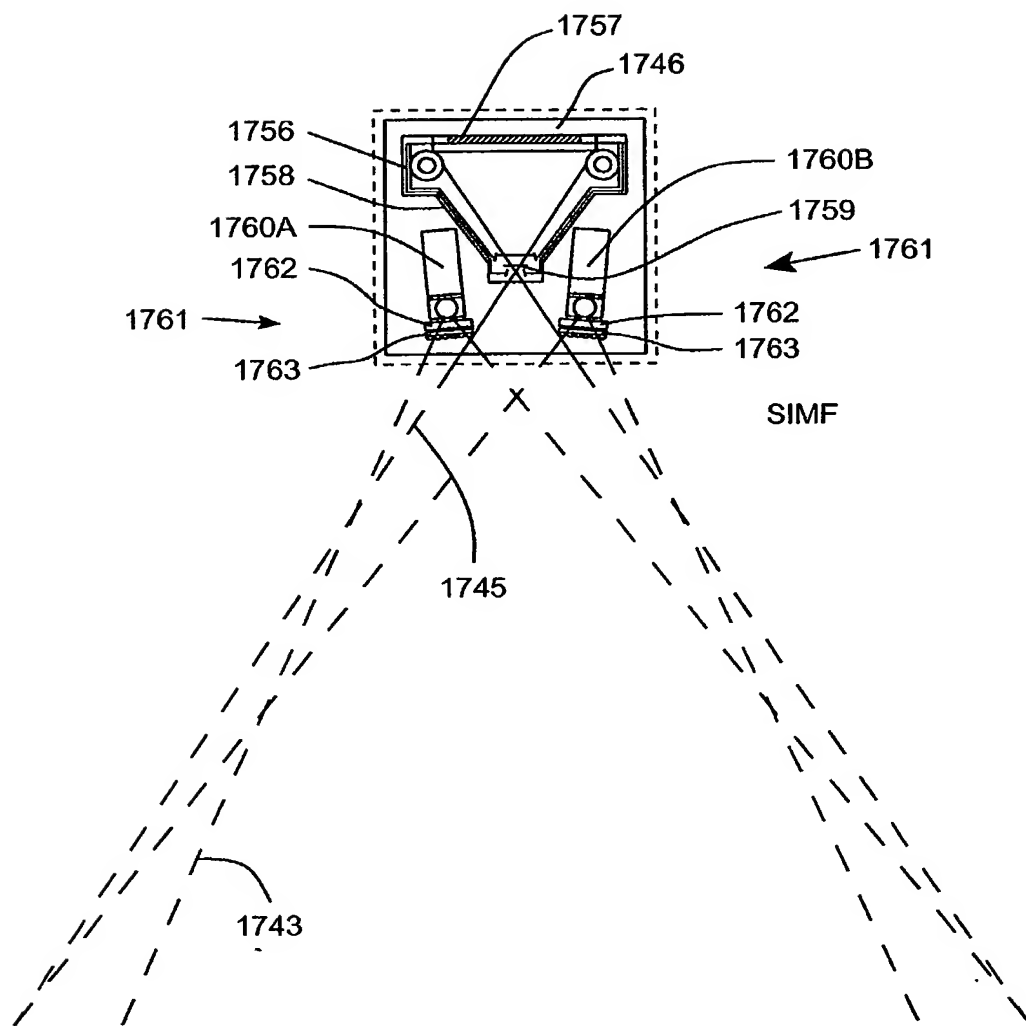


FIG. 49C

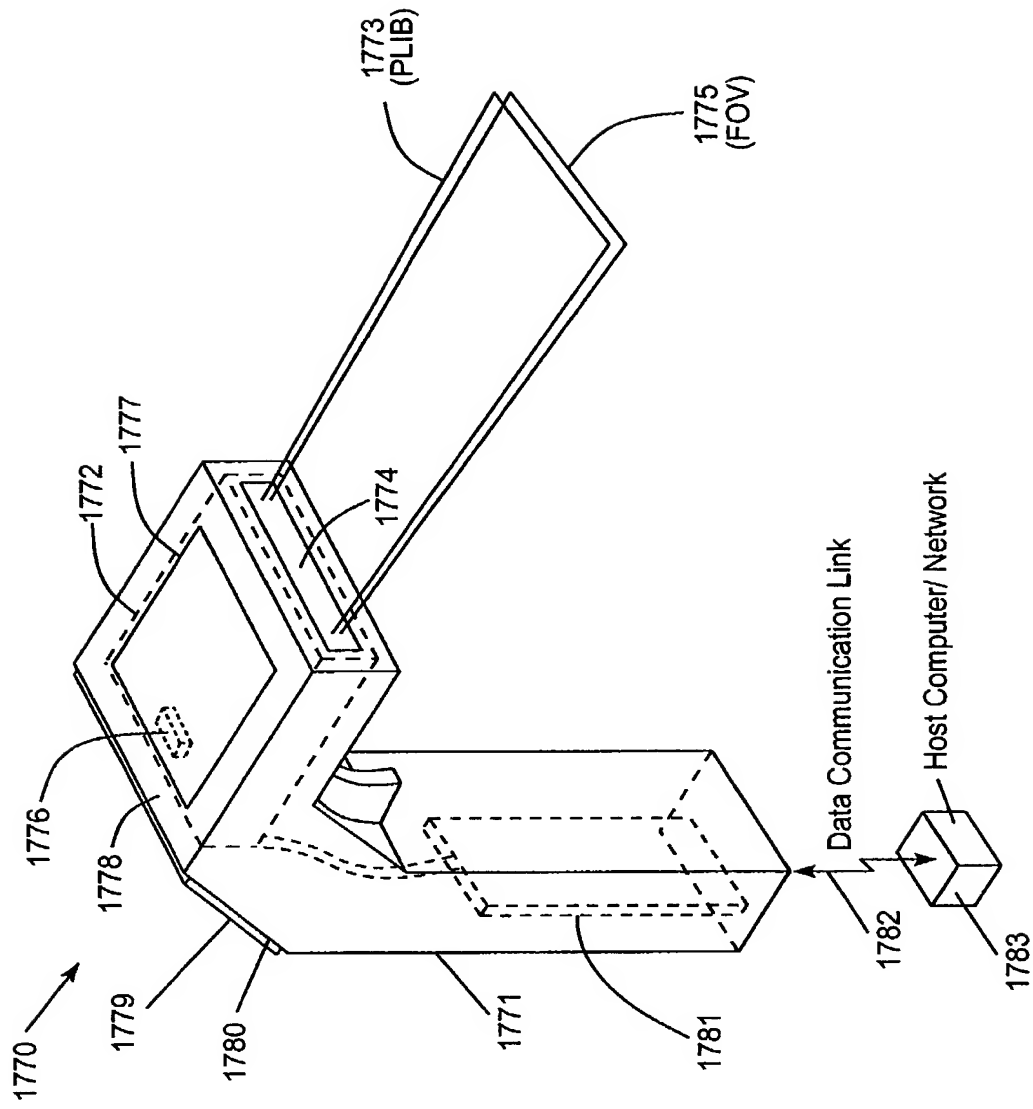


FIG. 50A

1001

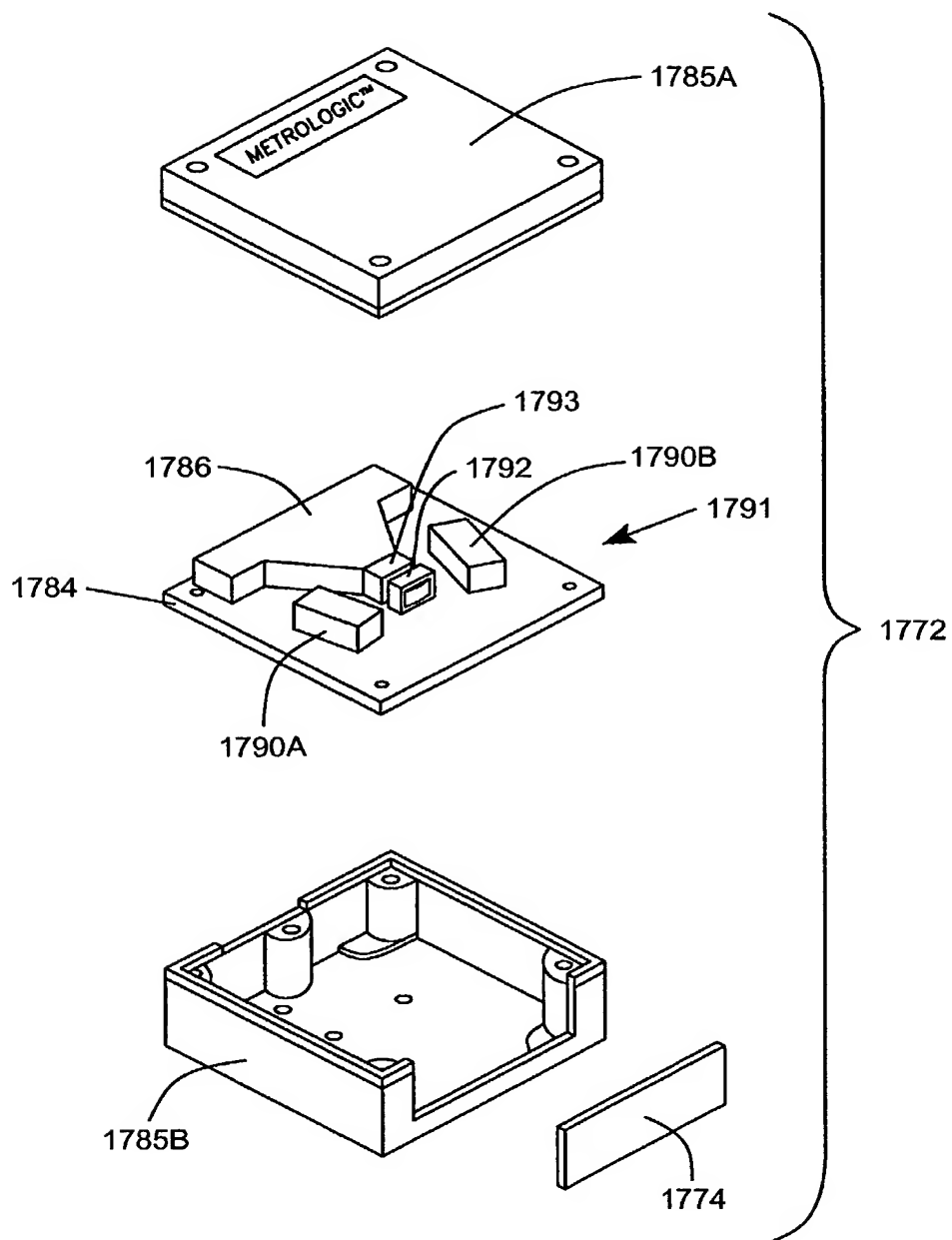


FIG. 50B

1017

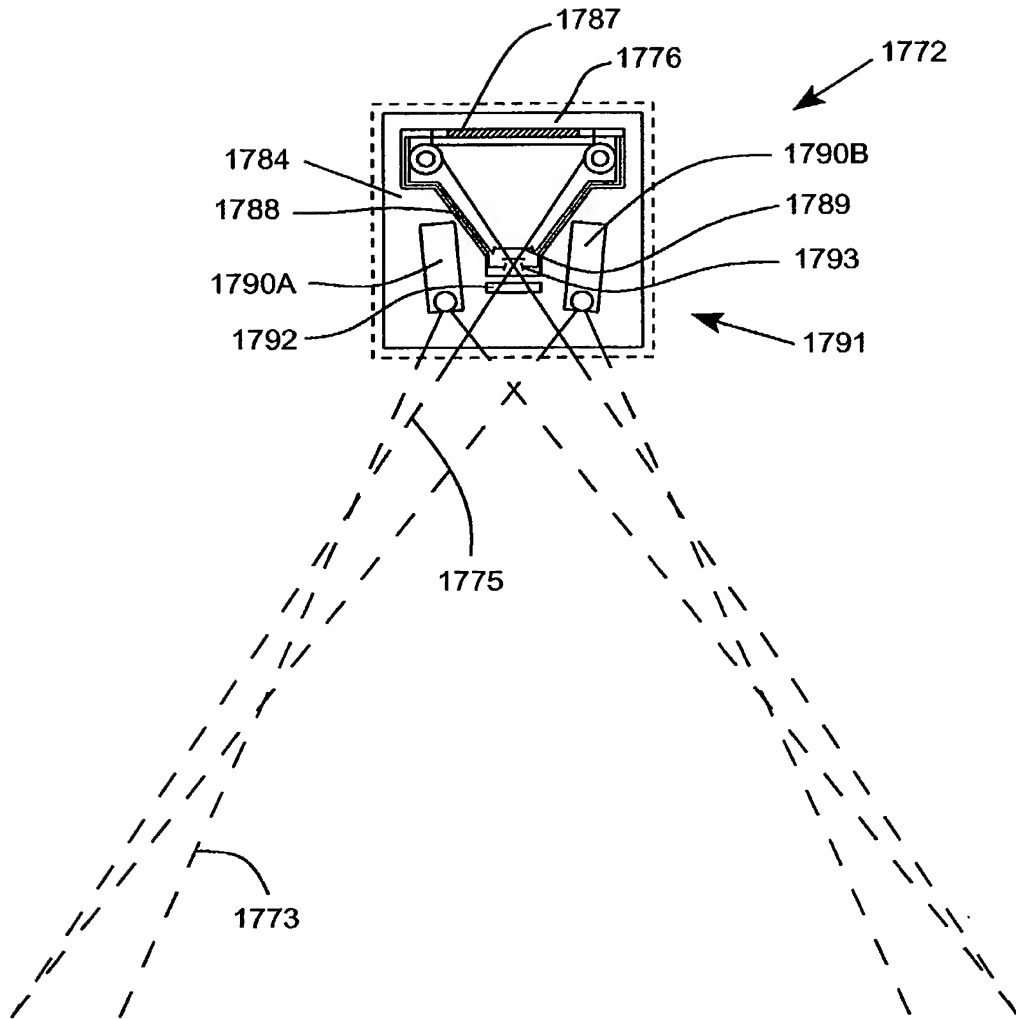


FIG. 50C

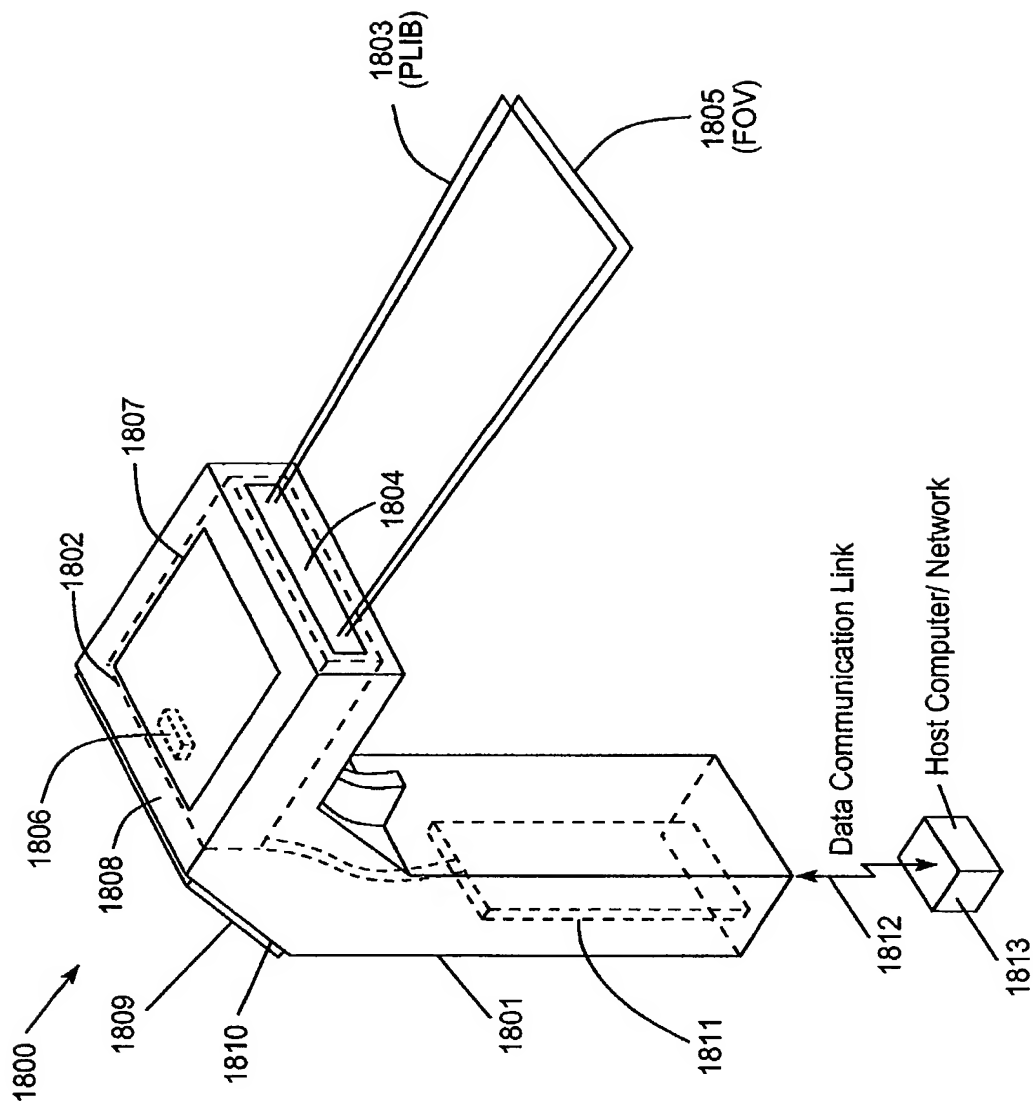


FIG. 51A

1800 1801 1802 1803 1804 1805 1806 1807 1808 1809 1810 1811 1812 1813

1800 1801

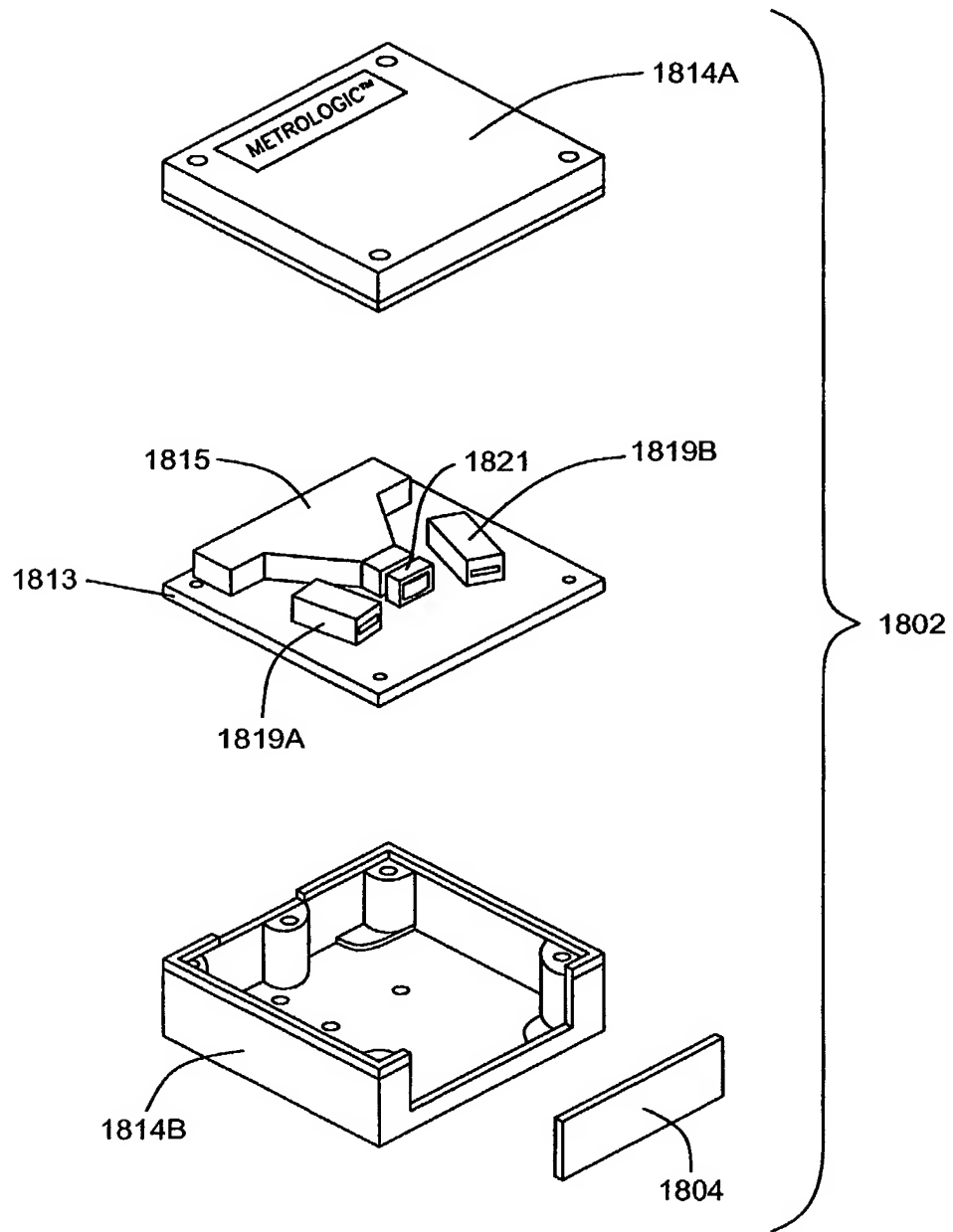


FIG. 51B



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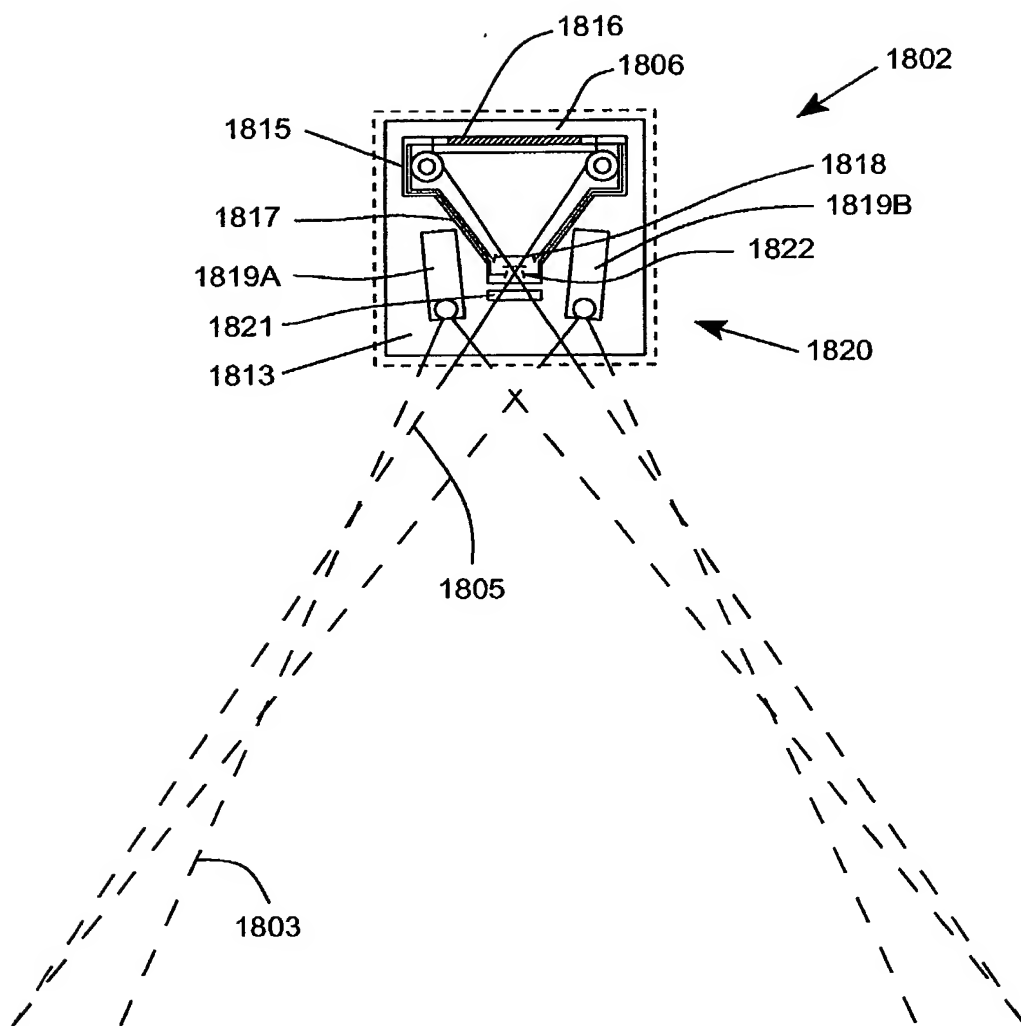


FIG. 51C

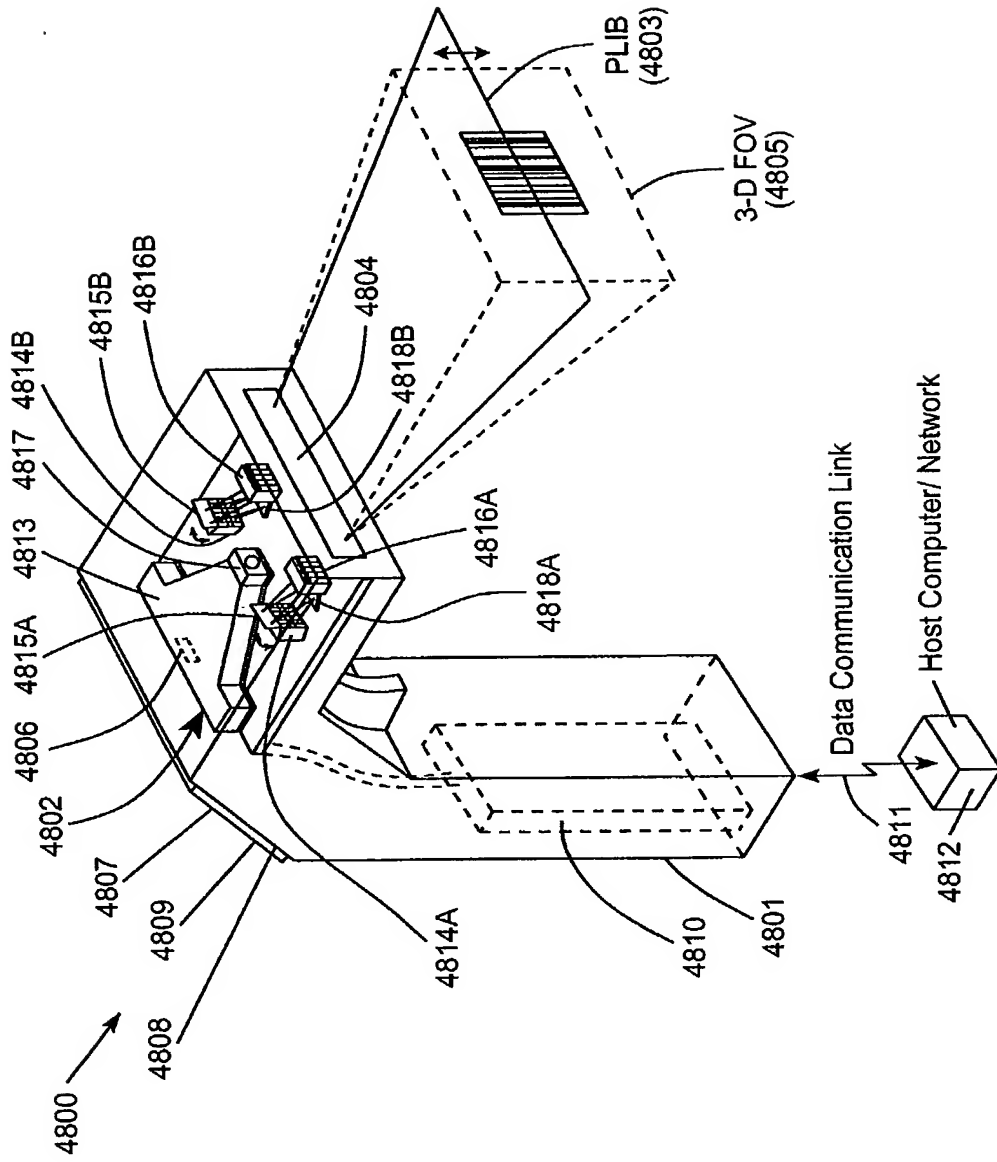
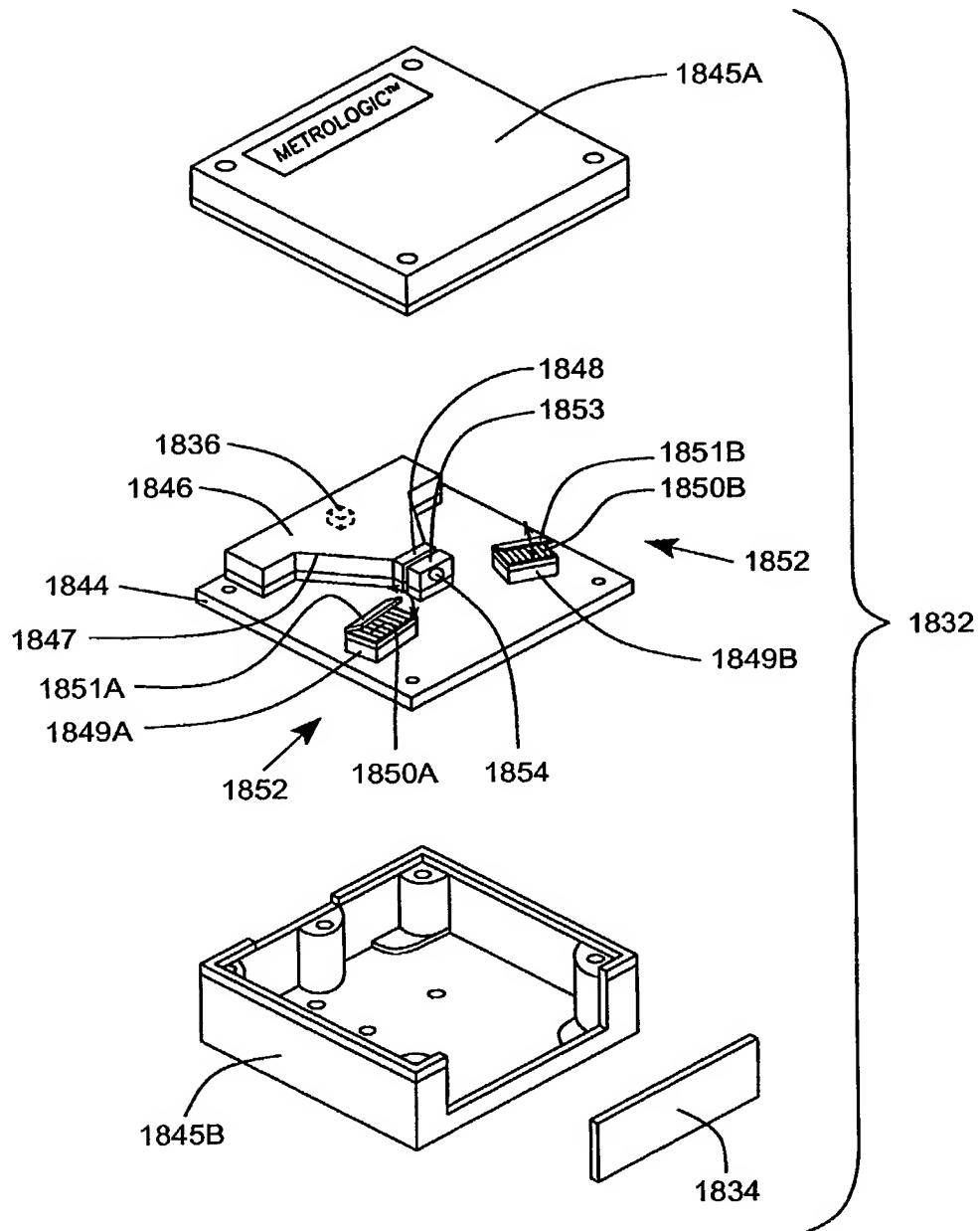


FIG. 52





**Fig. 1I3A-3B**

FIG. 52B

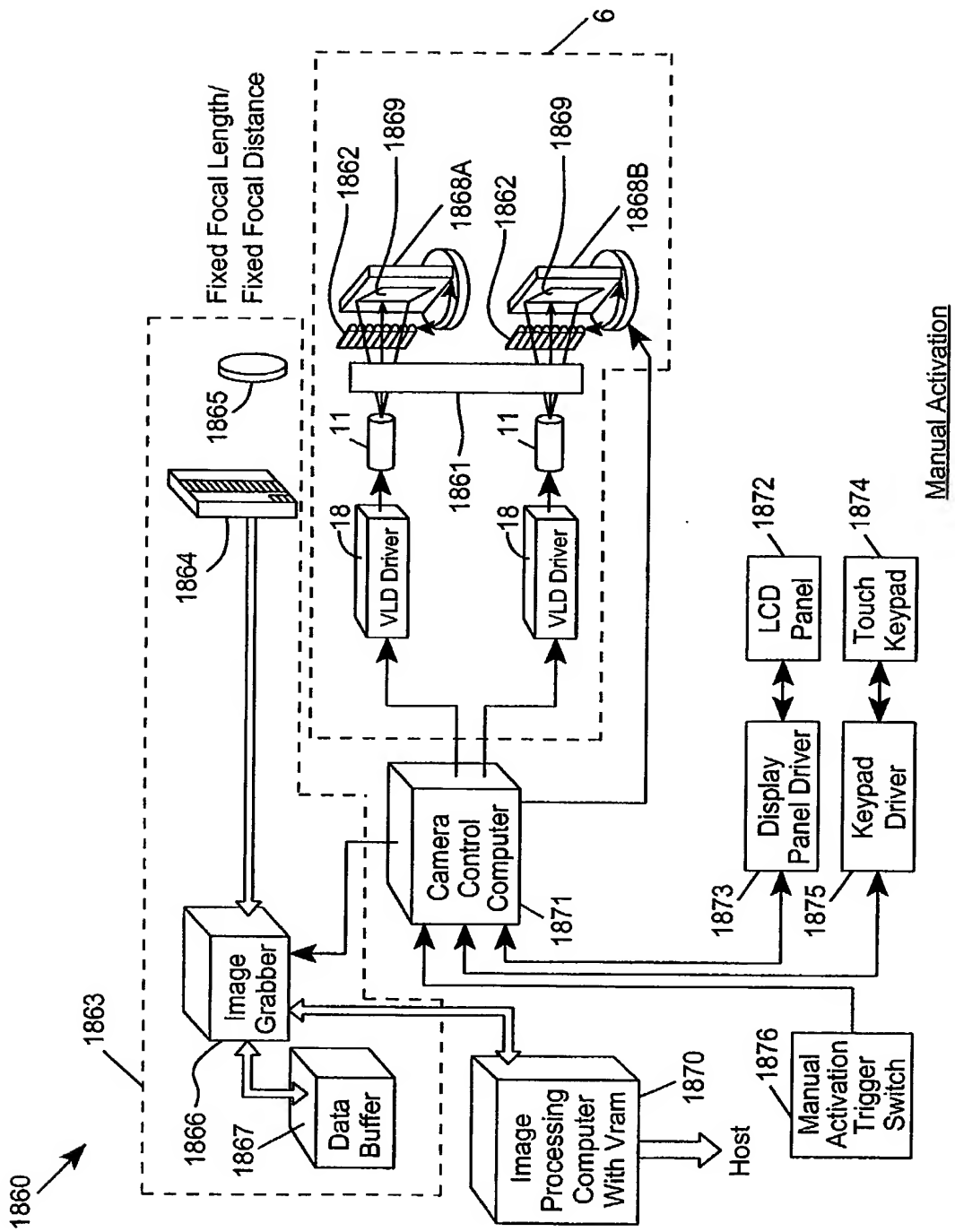
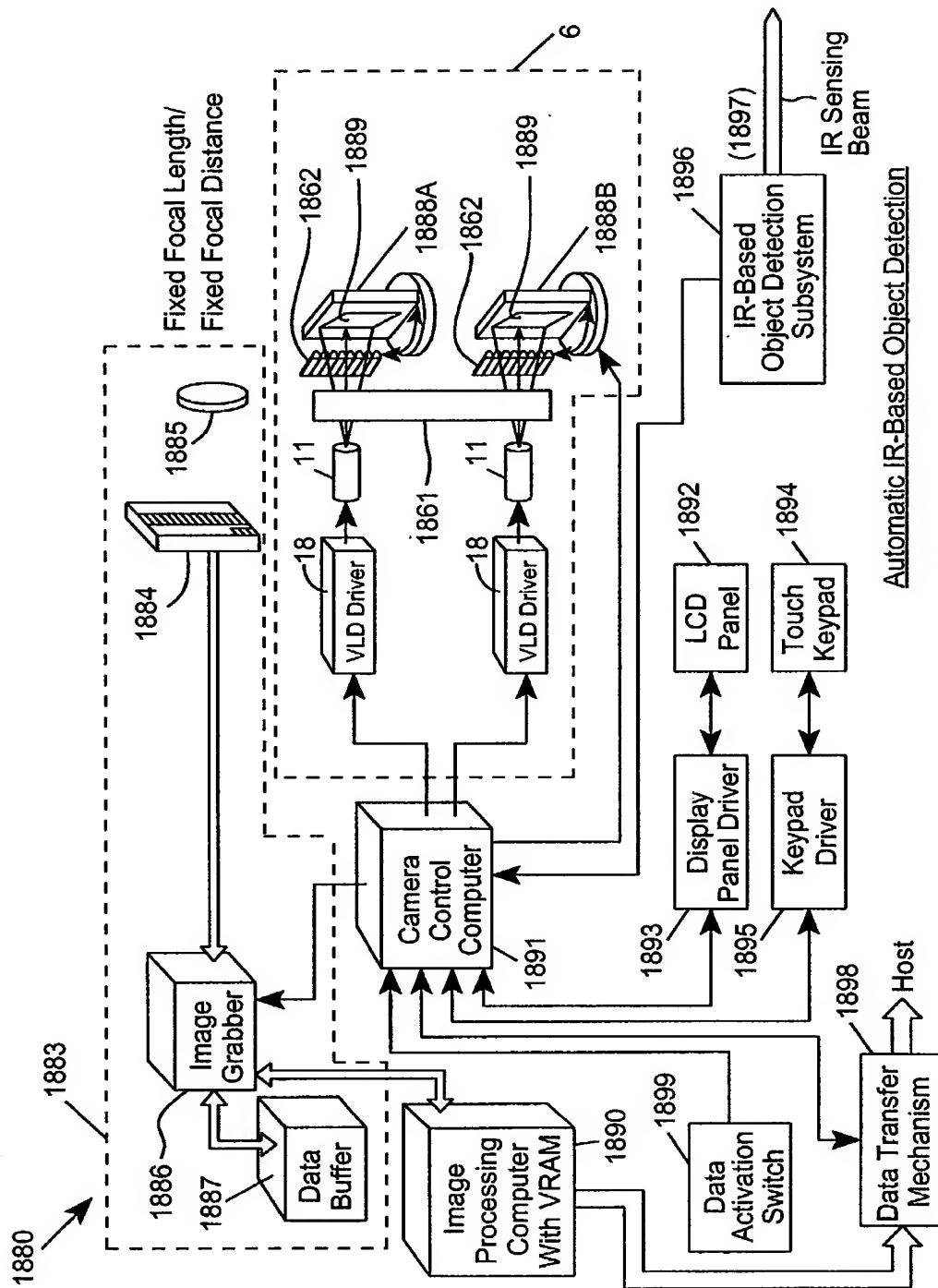


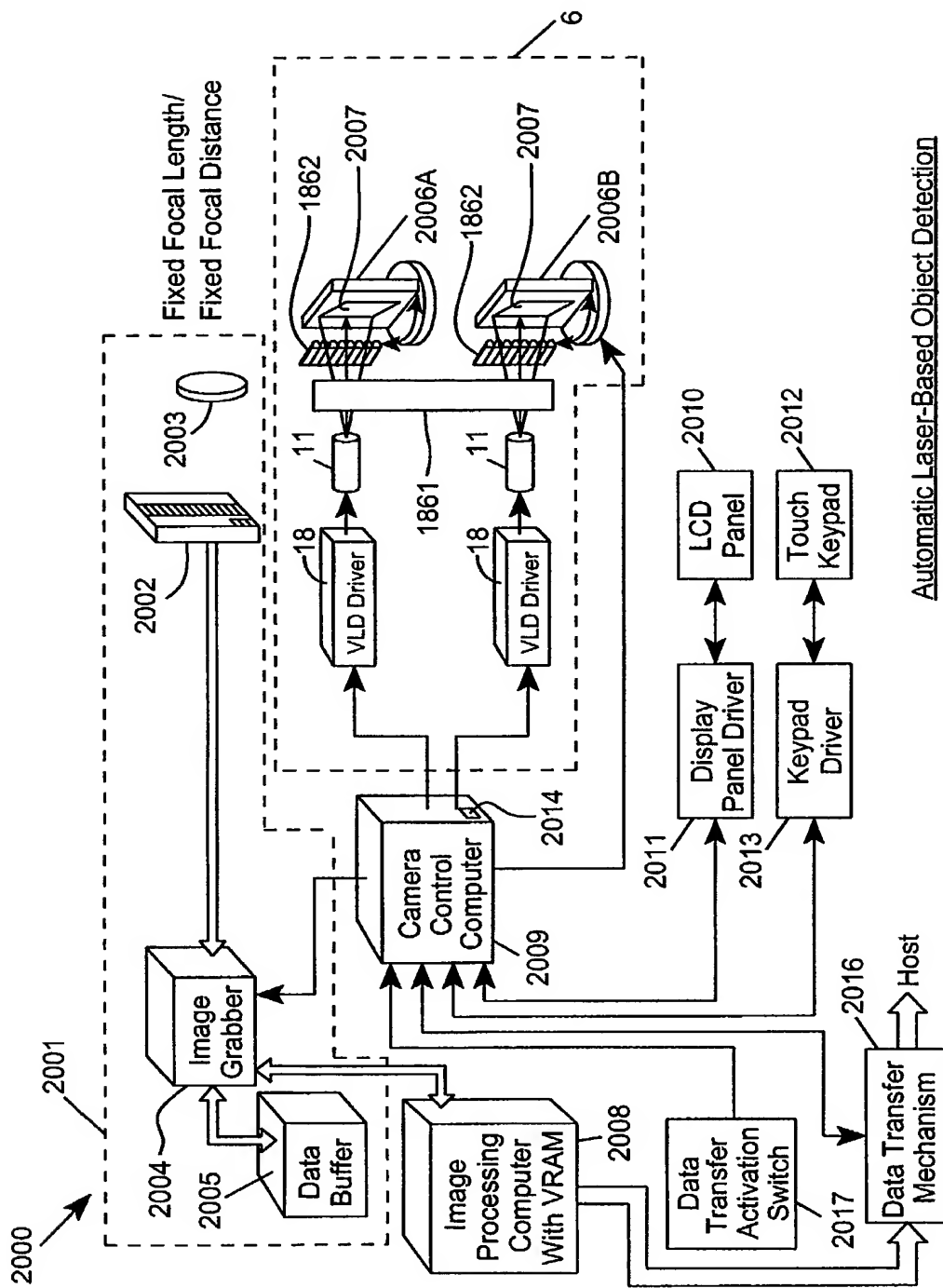
FIG. 53A1

1860 1864 1865 1866 1867 1868A 1868B 1869 1870 1871 1872 1873 1874 1875 1876

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**FIG. 53A2**







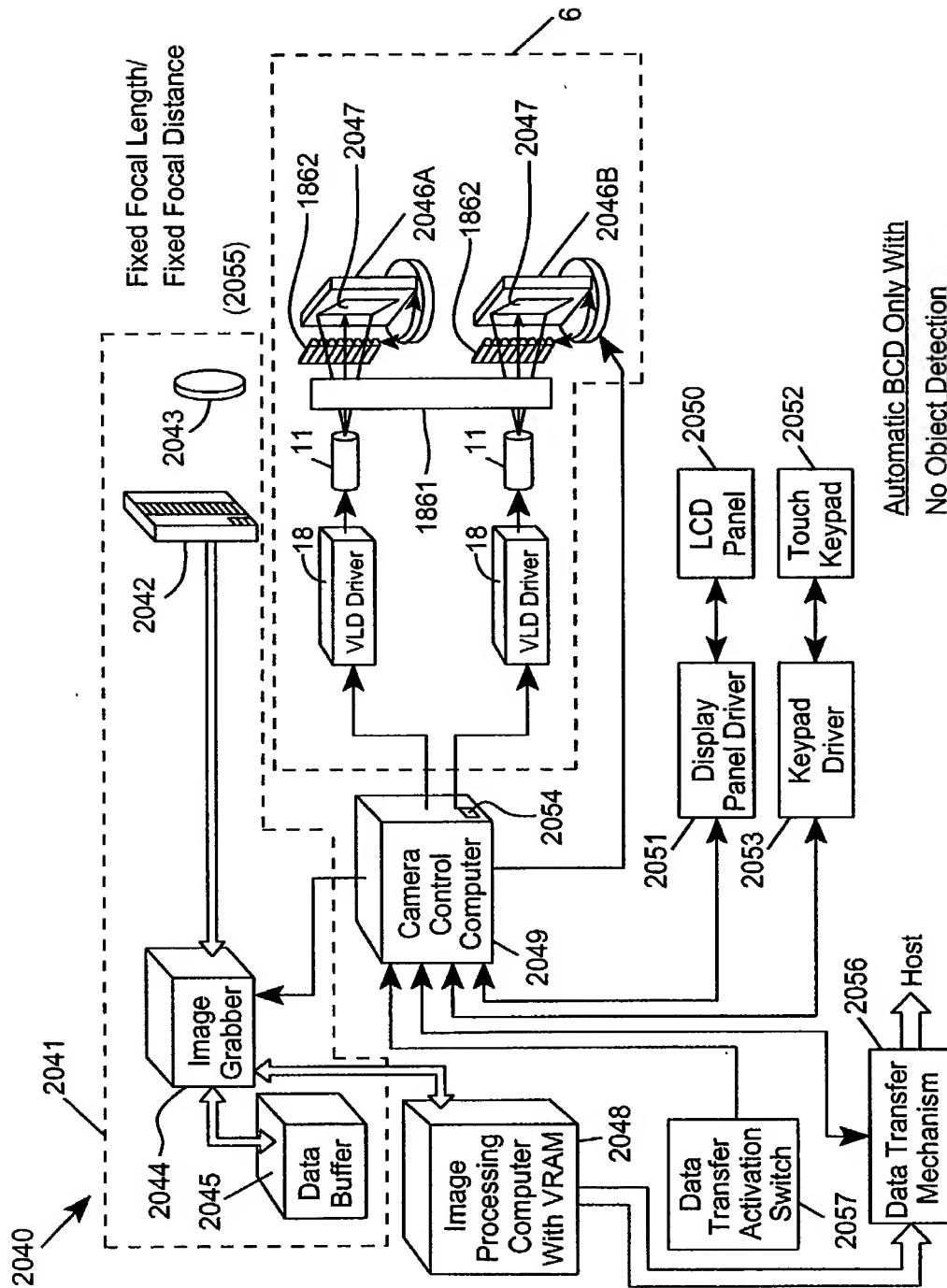


FIG. 53A5

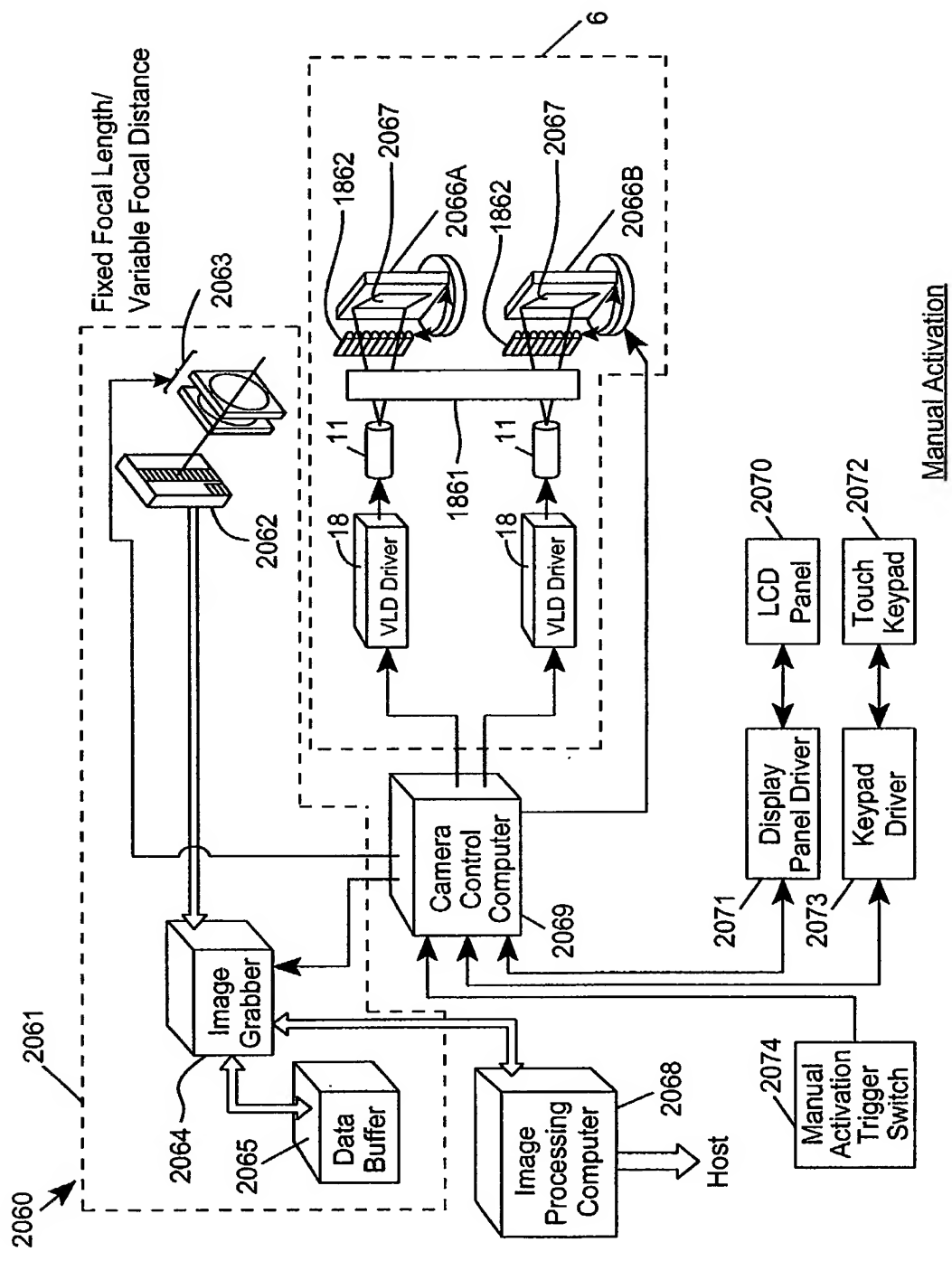
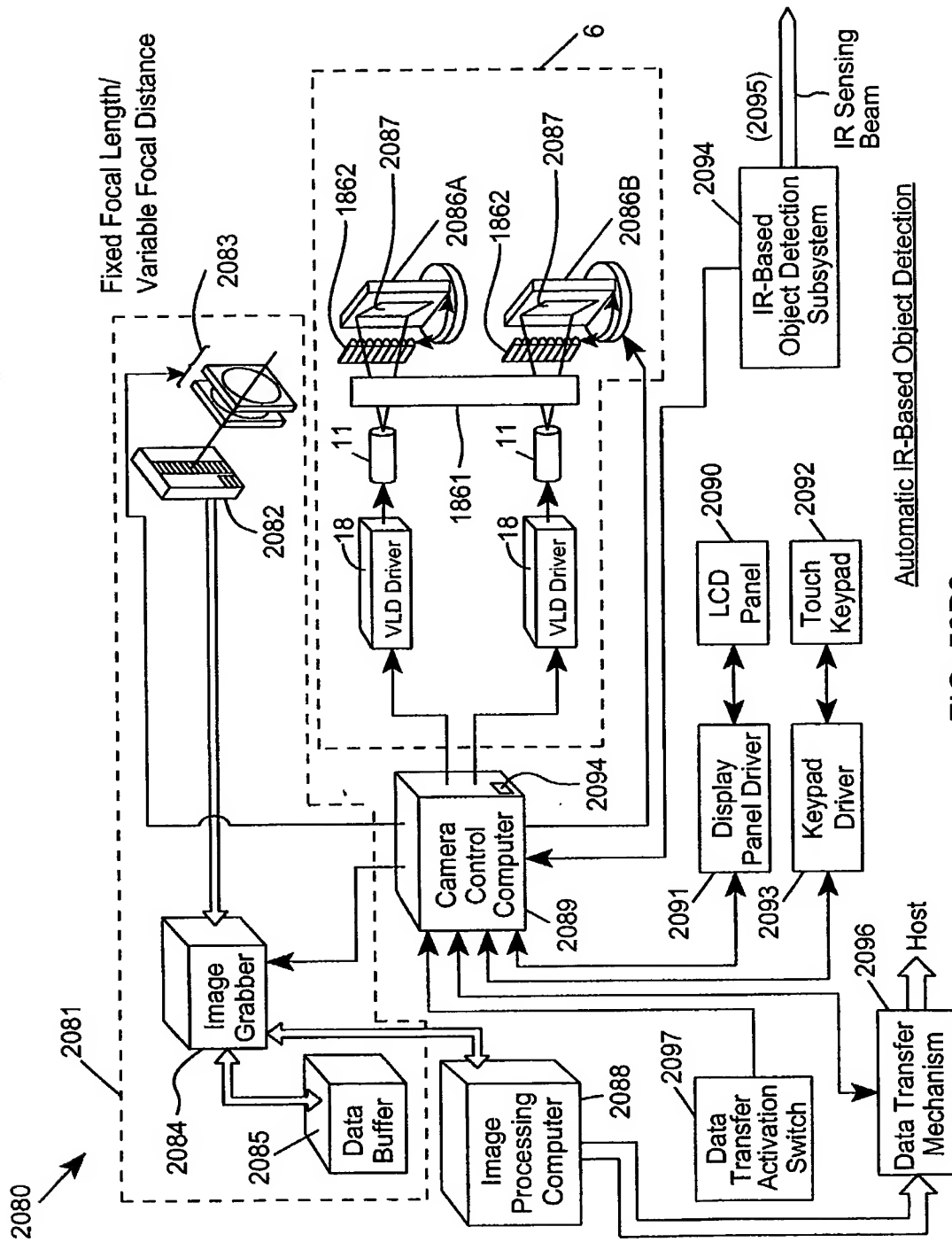
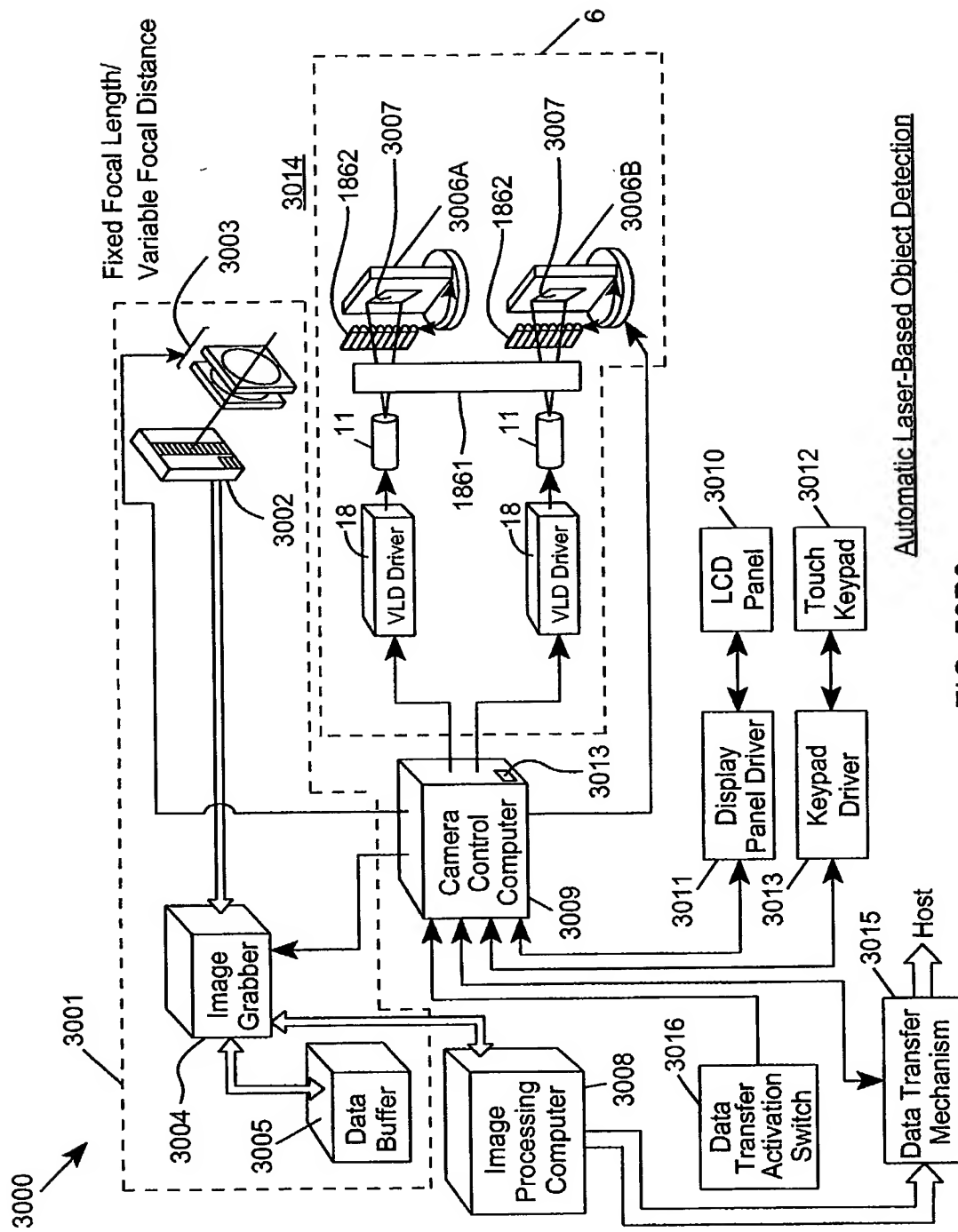


FIG. 53B1

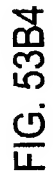


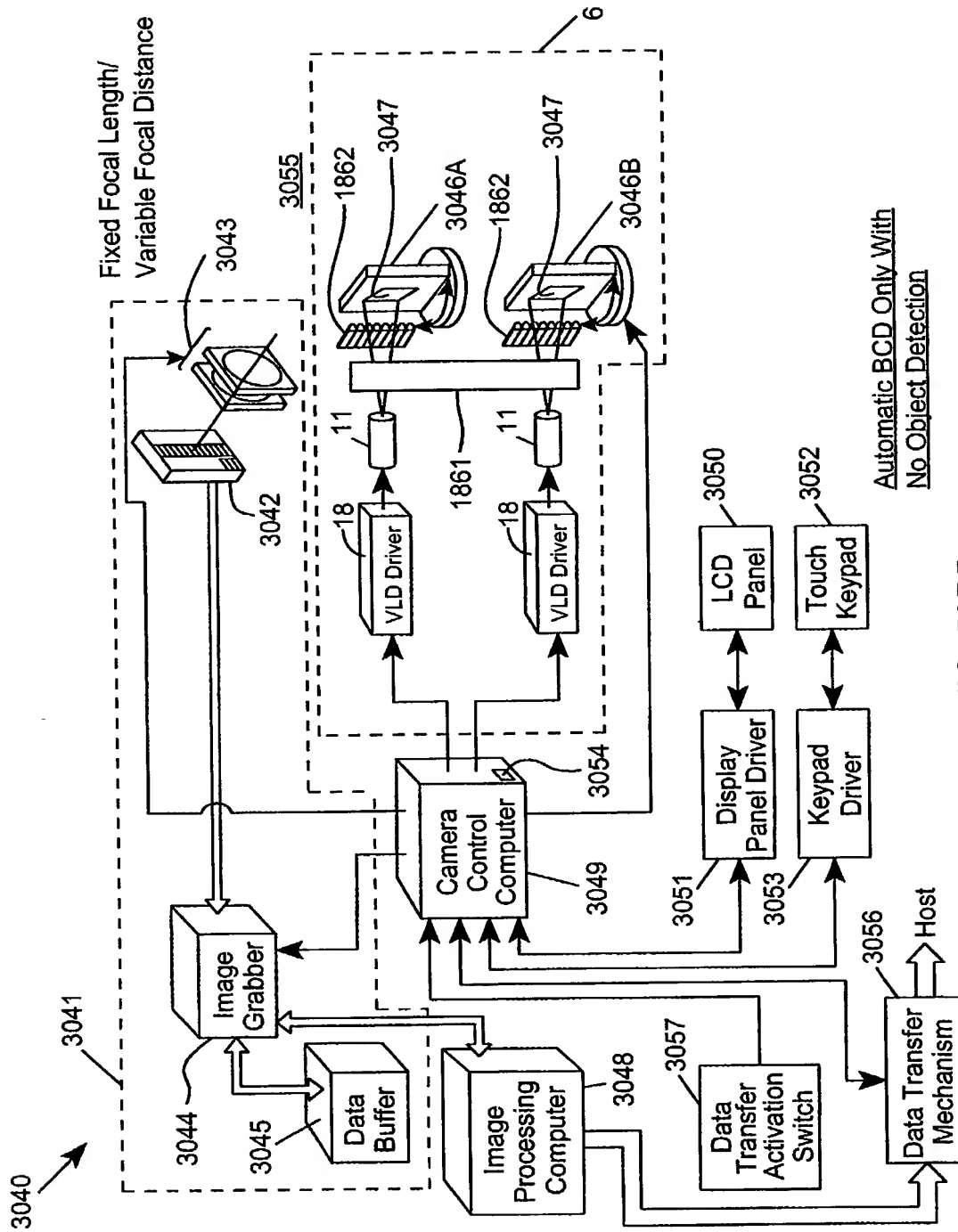
**FIG. 53B2**



Automatic Laser-Based Object Detection

FIG. 53B3





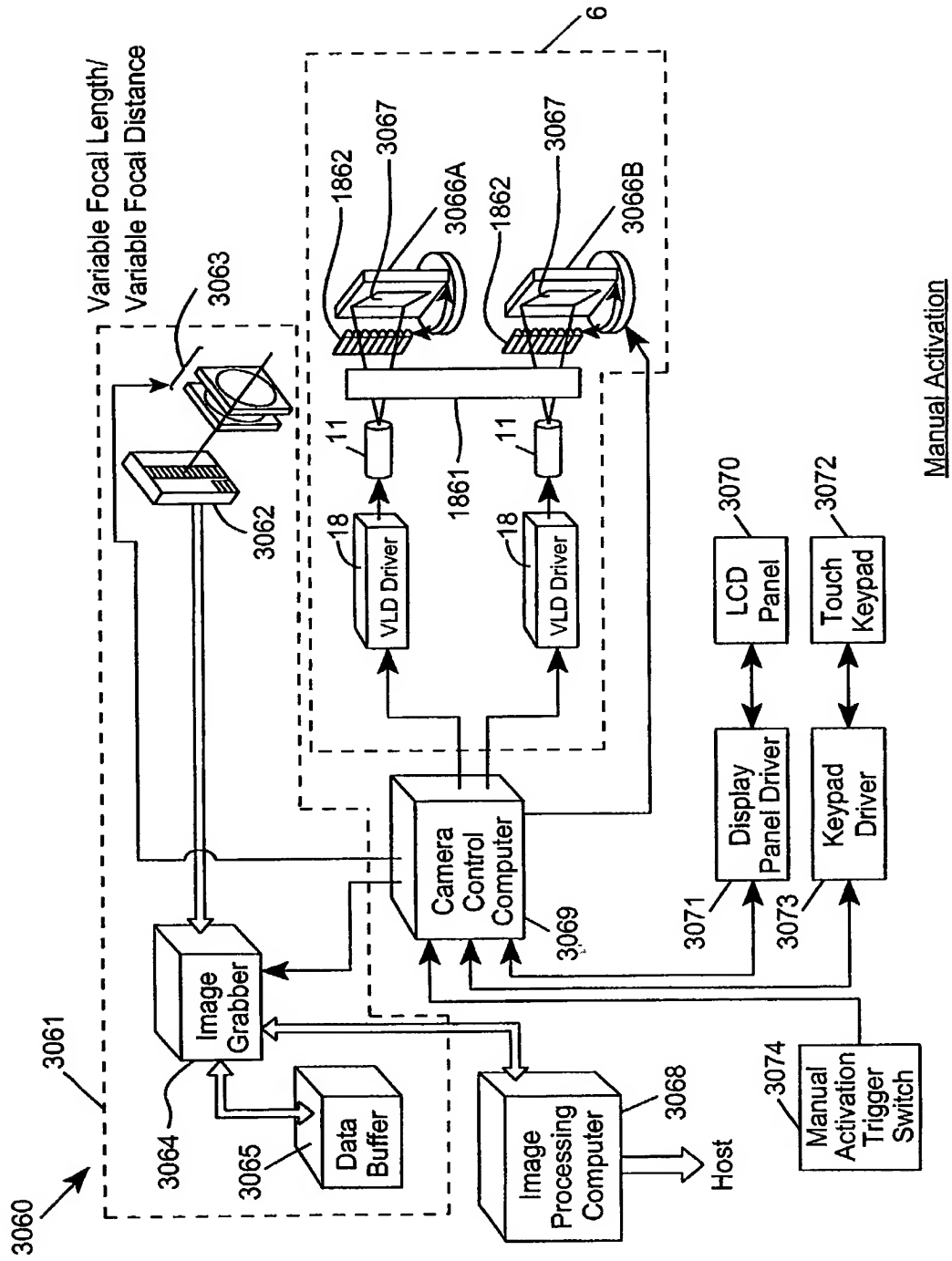
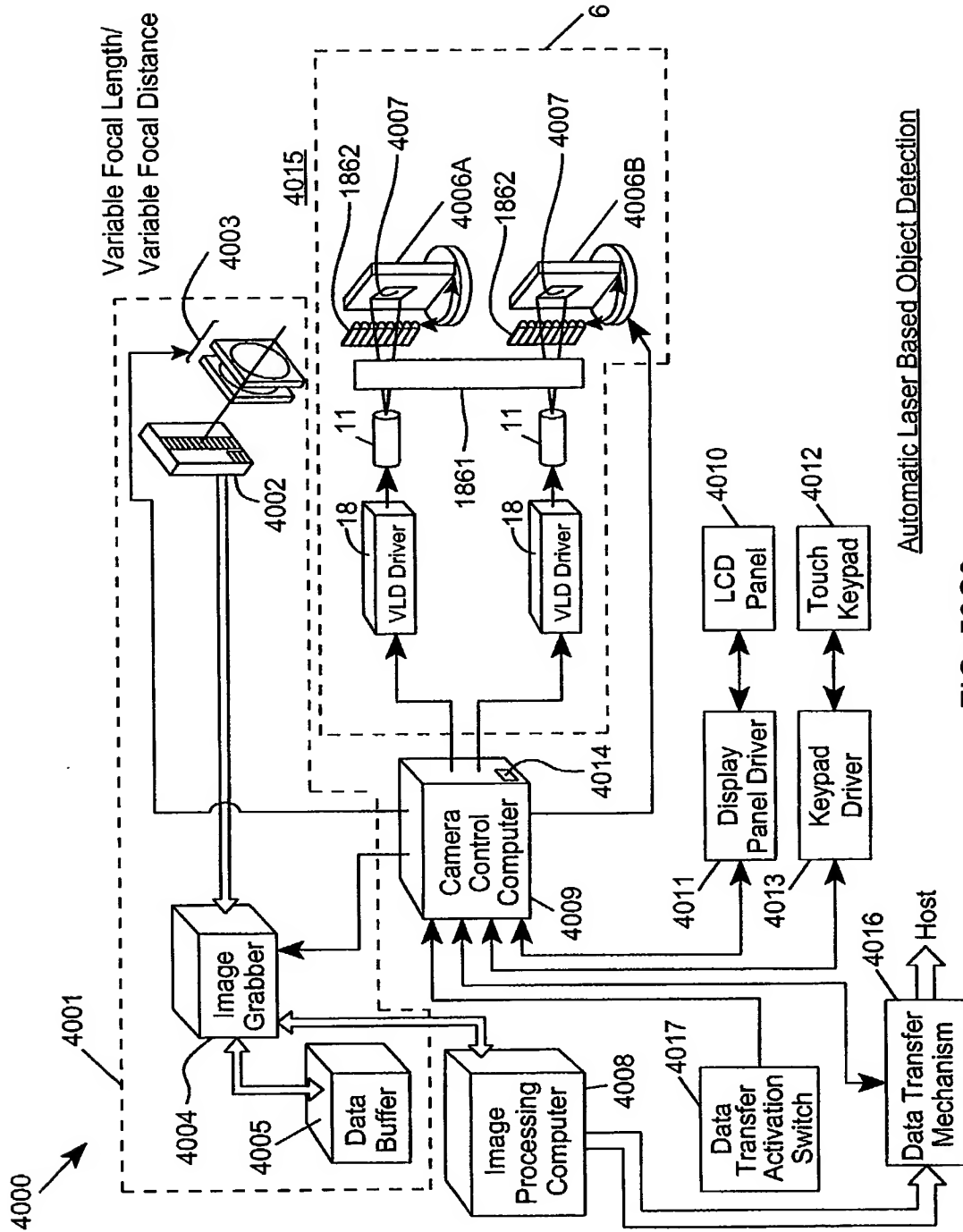


FIG. 53C1



**FIG. 53C2**





Automatic Laser Based Object Detection

FIG. 53C3

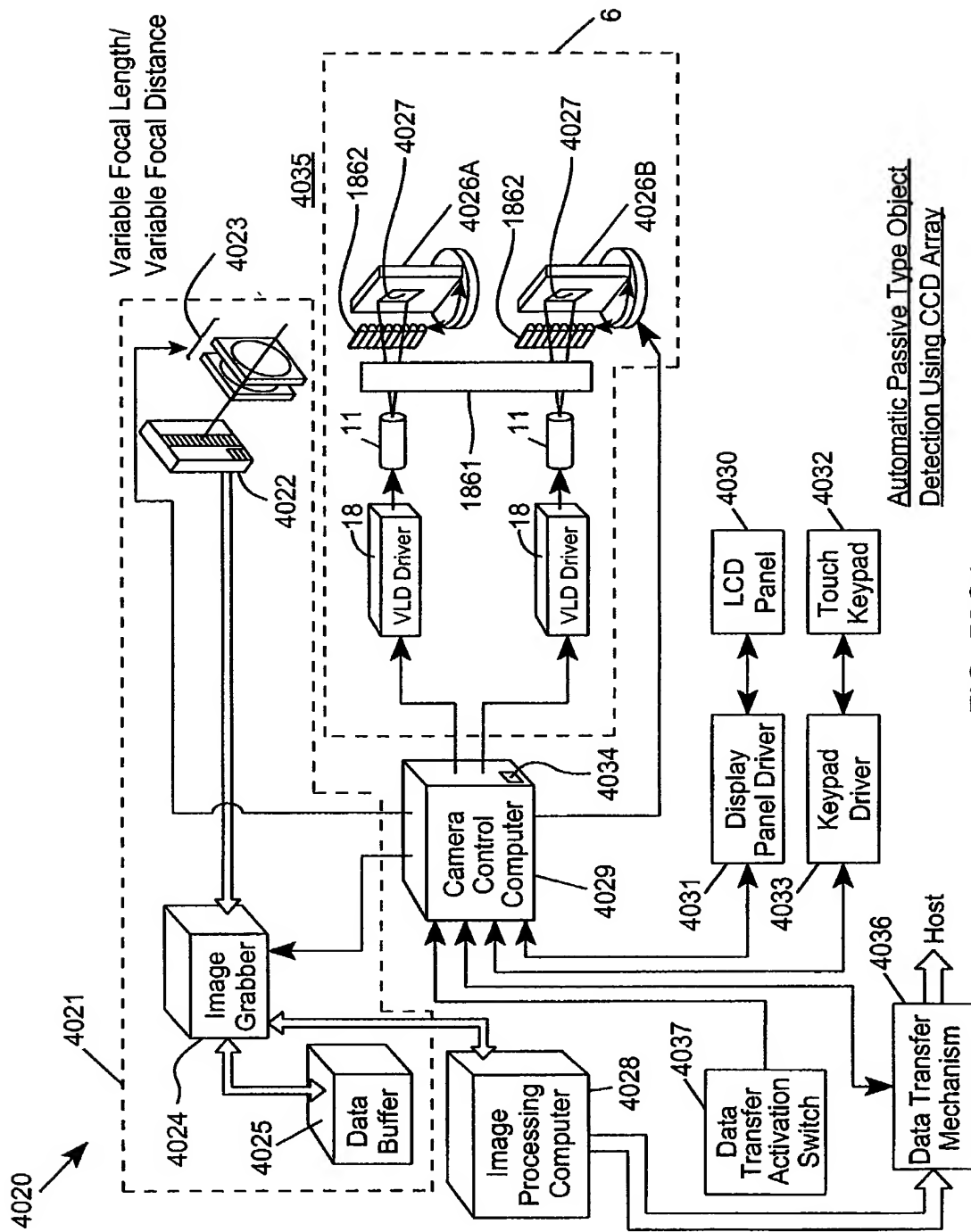


FIG. 53C4

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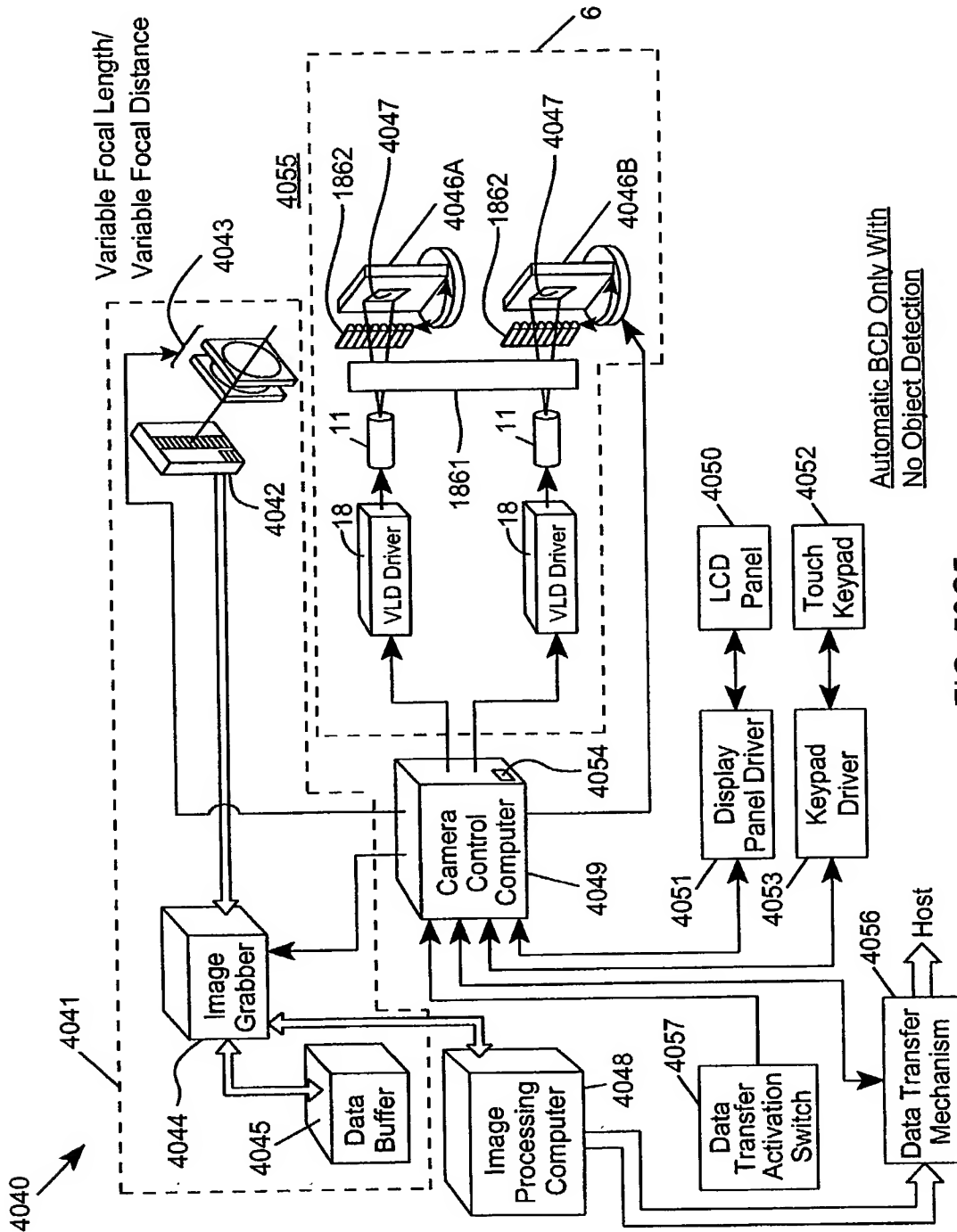


FIG. 53C5

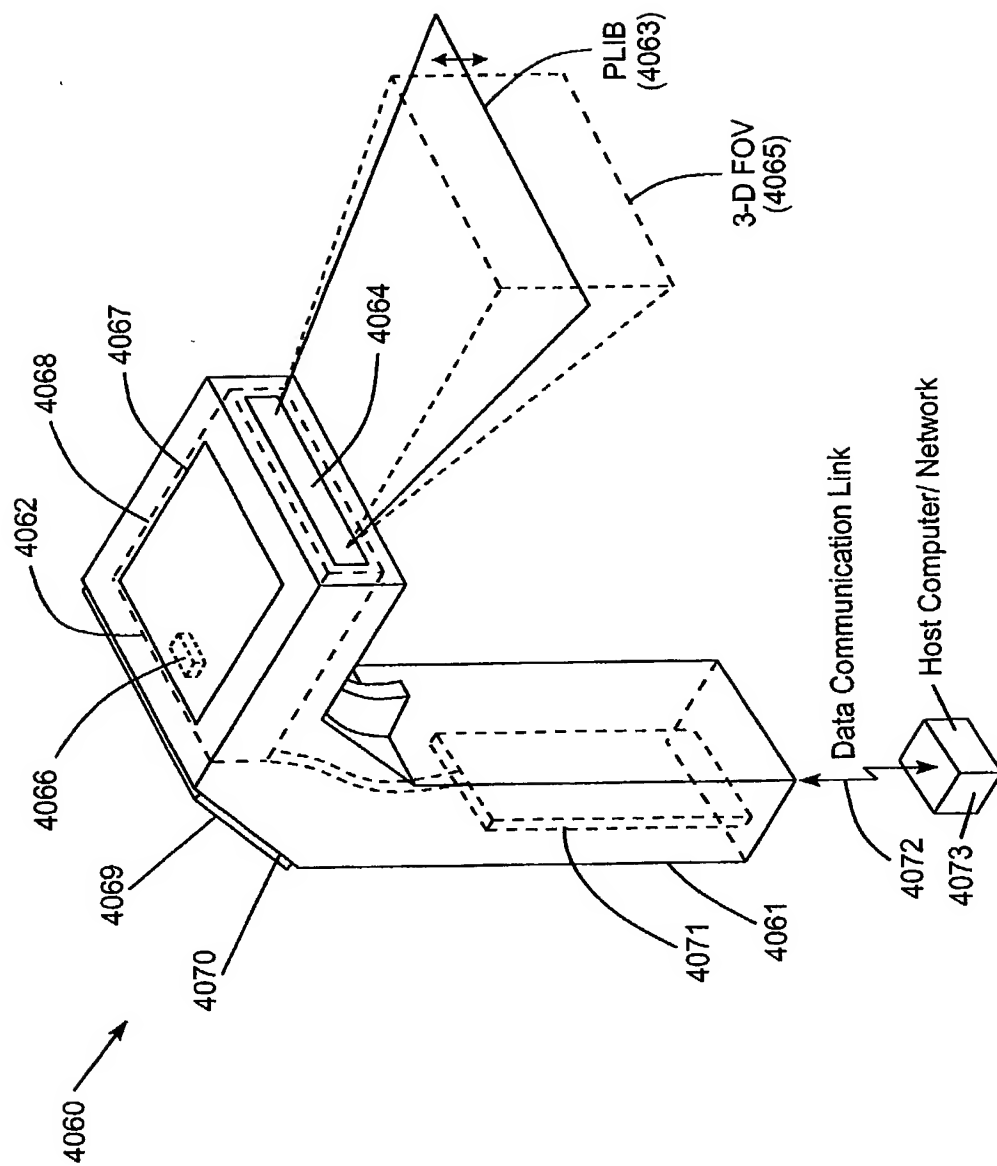
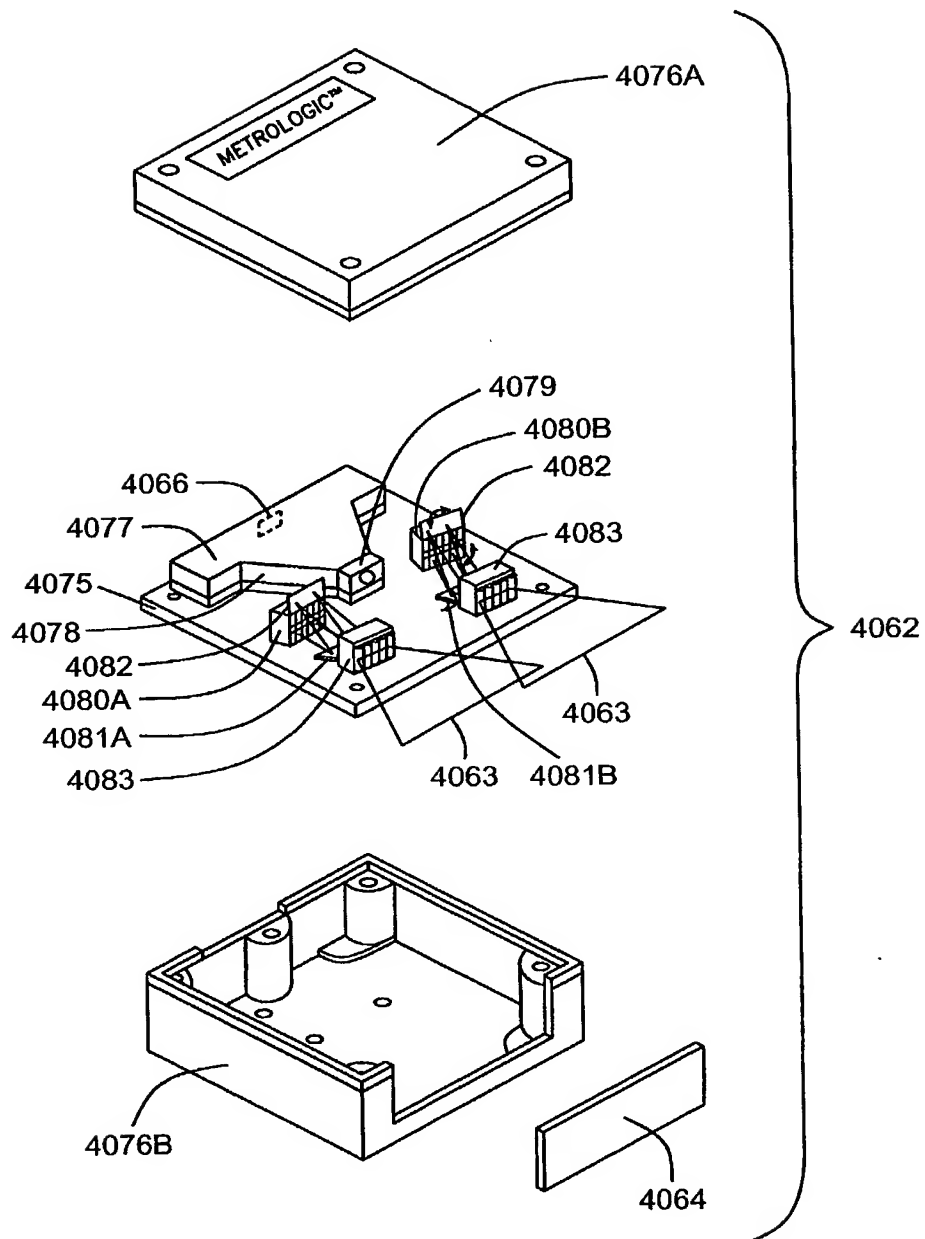


FIG. 54A

115A-5D



(Dual Mirrors)  
Fig. 115A-5D

FIG. 54B

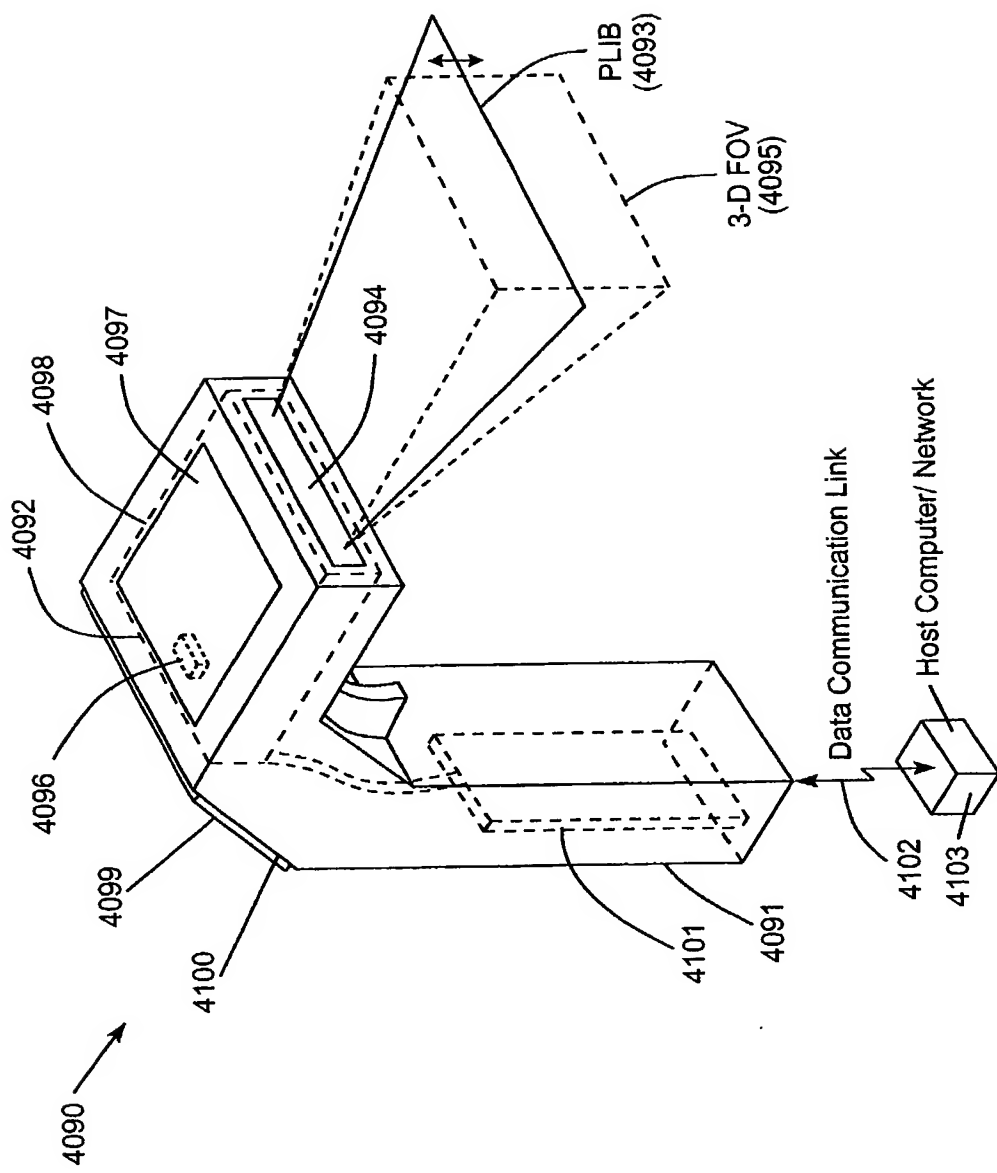


FIG. 55A

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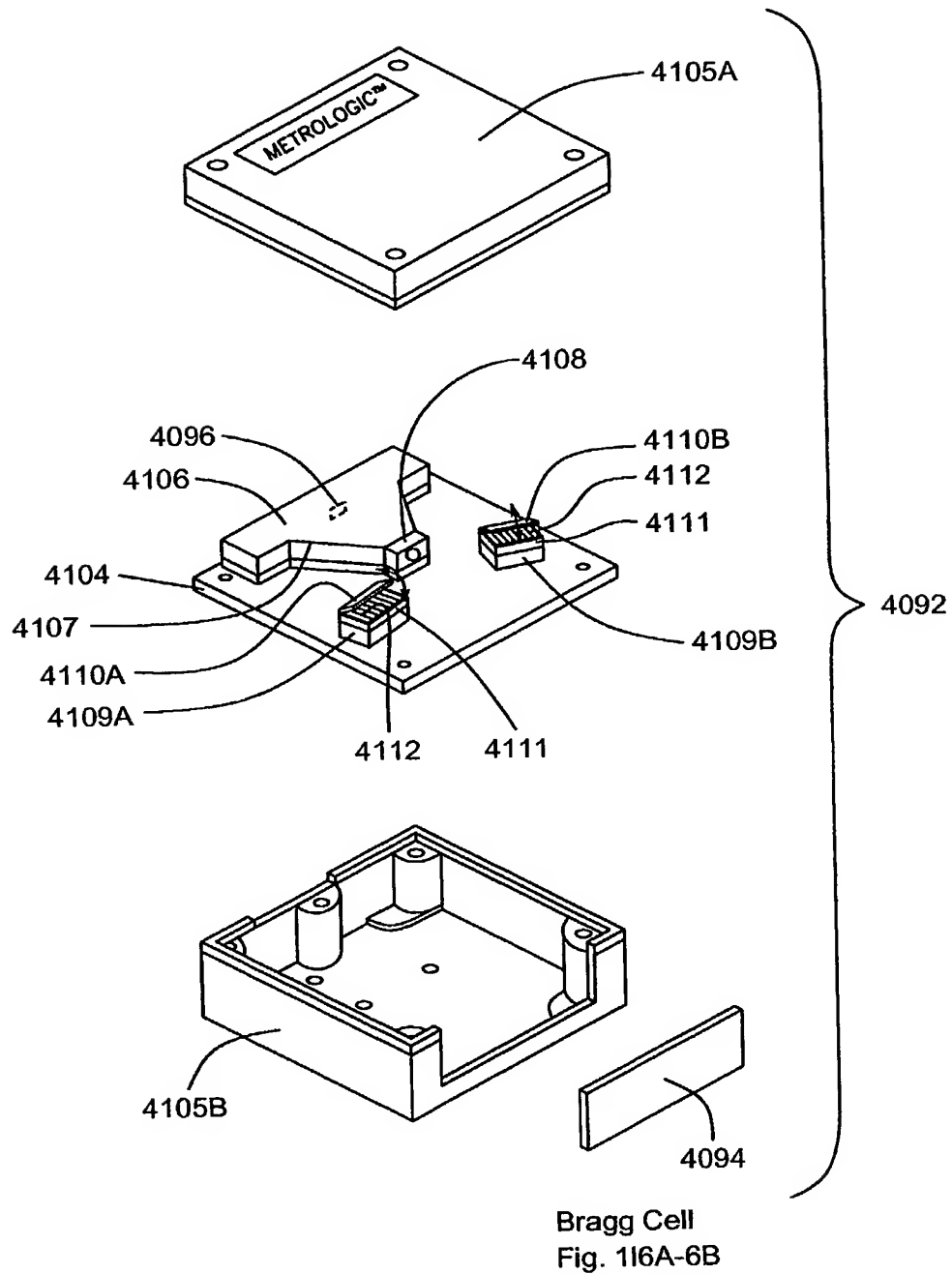
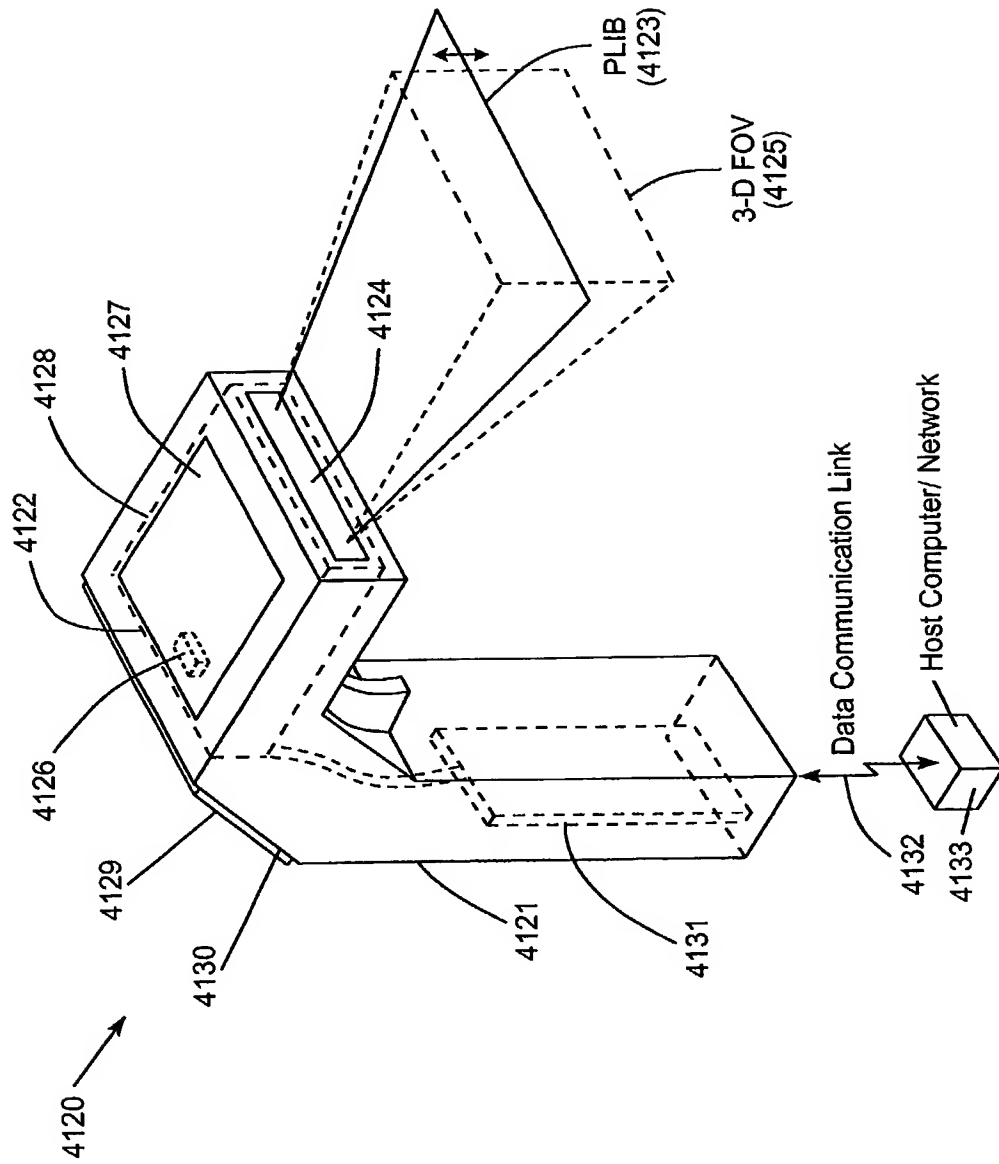
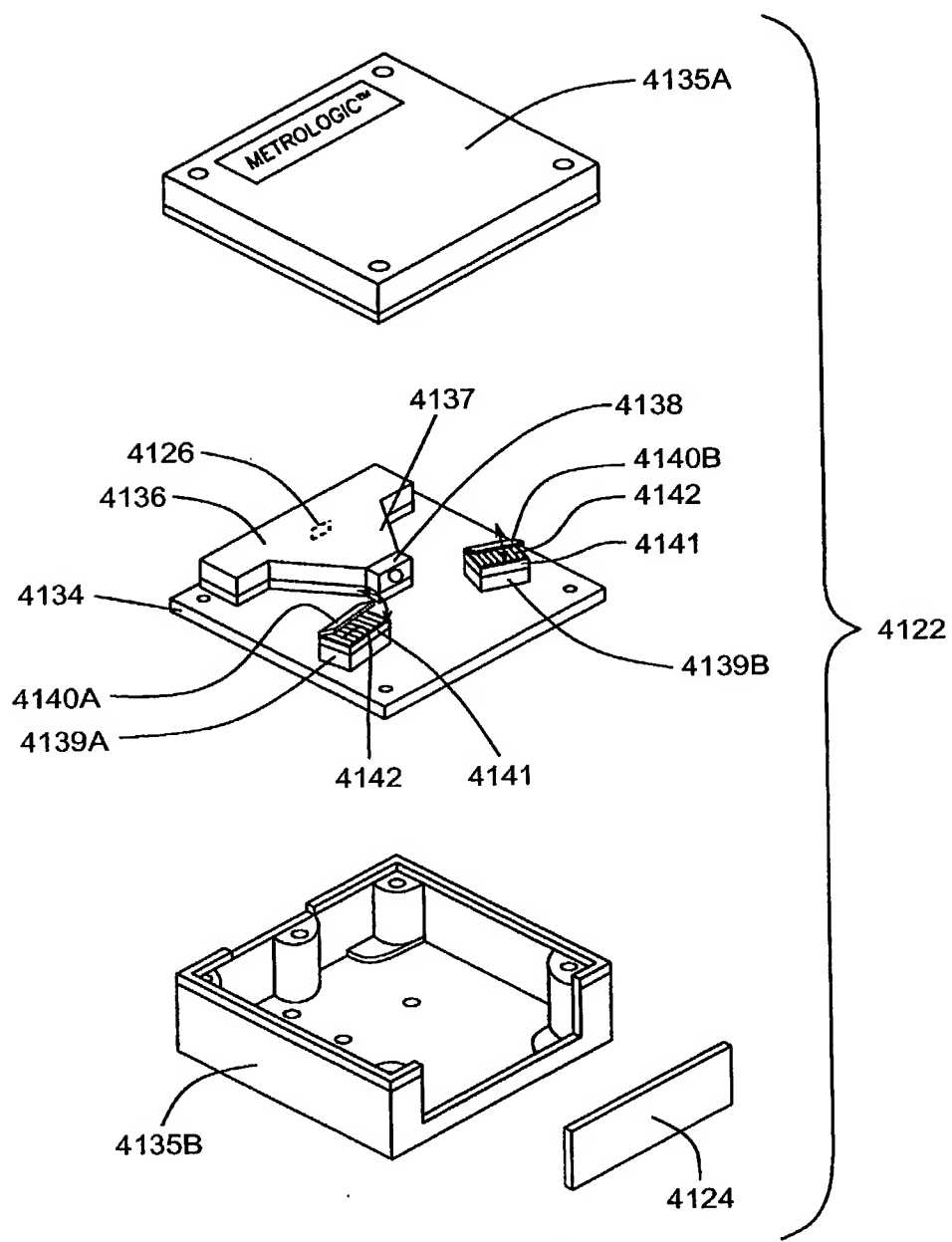


FIG. 55B



**FIG. 56A**





DM  
Fig. 117A-7B

FIG. 56B

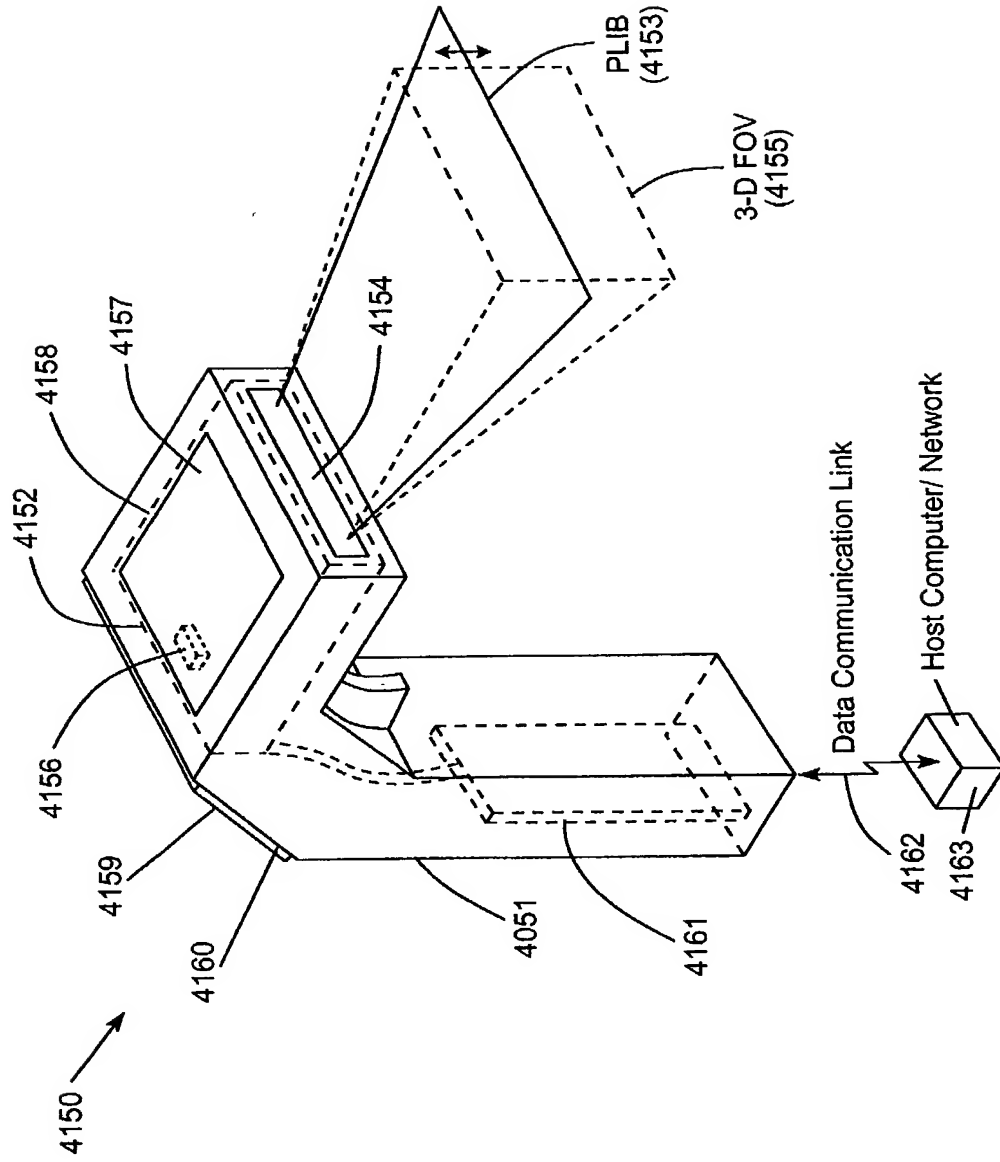


FIG. 57A

FIG. 57B

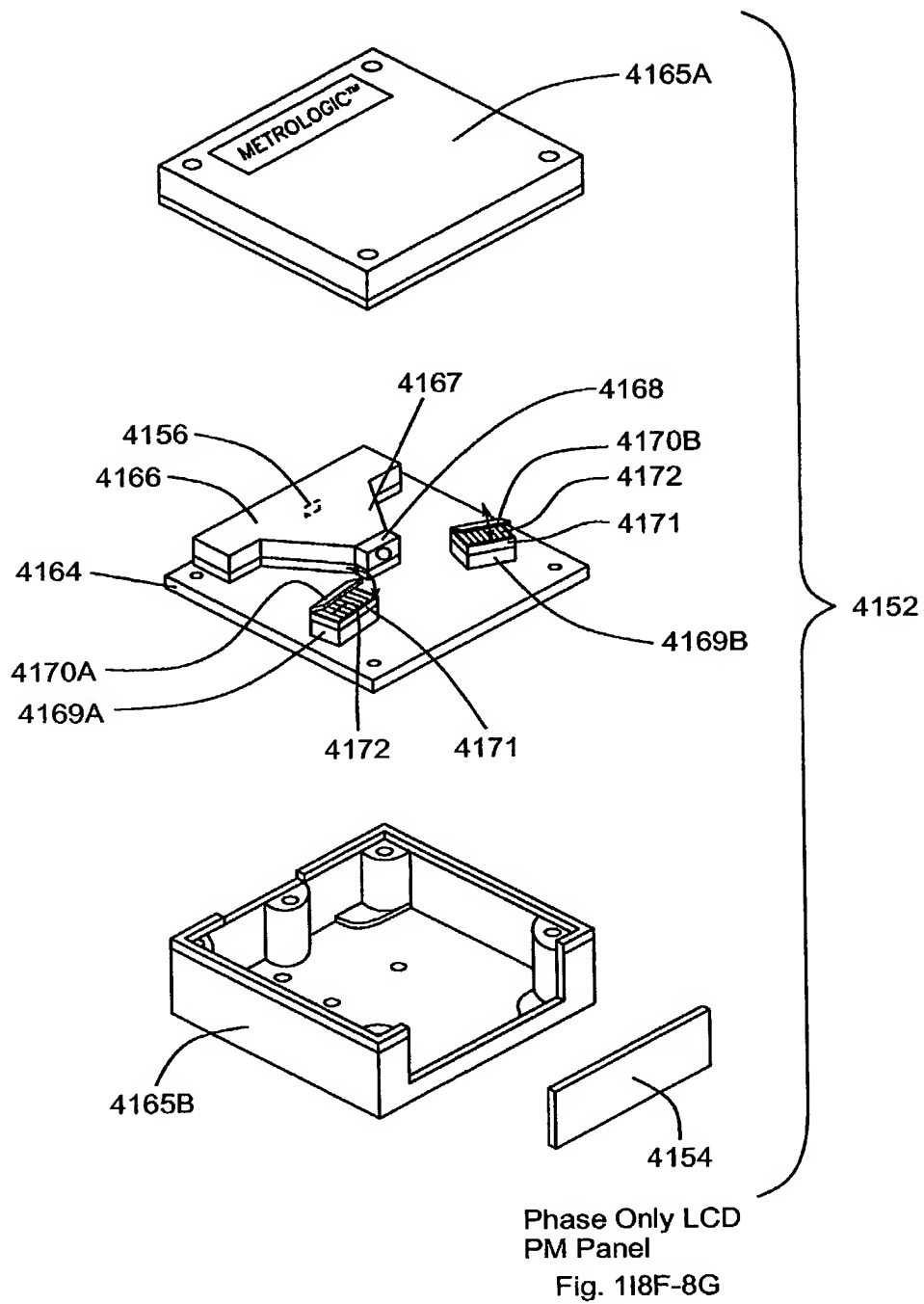


FIG. 57B

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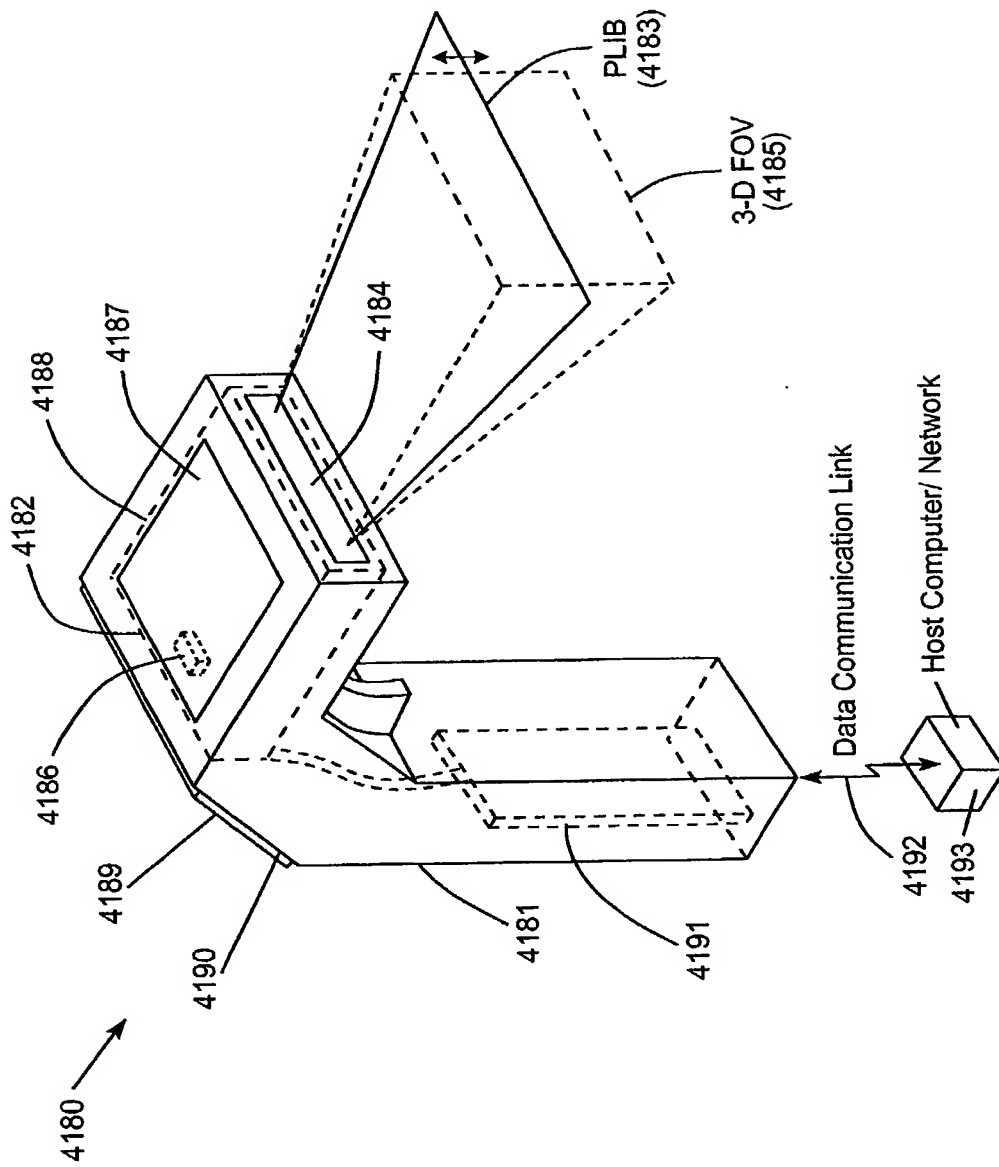
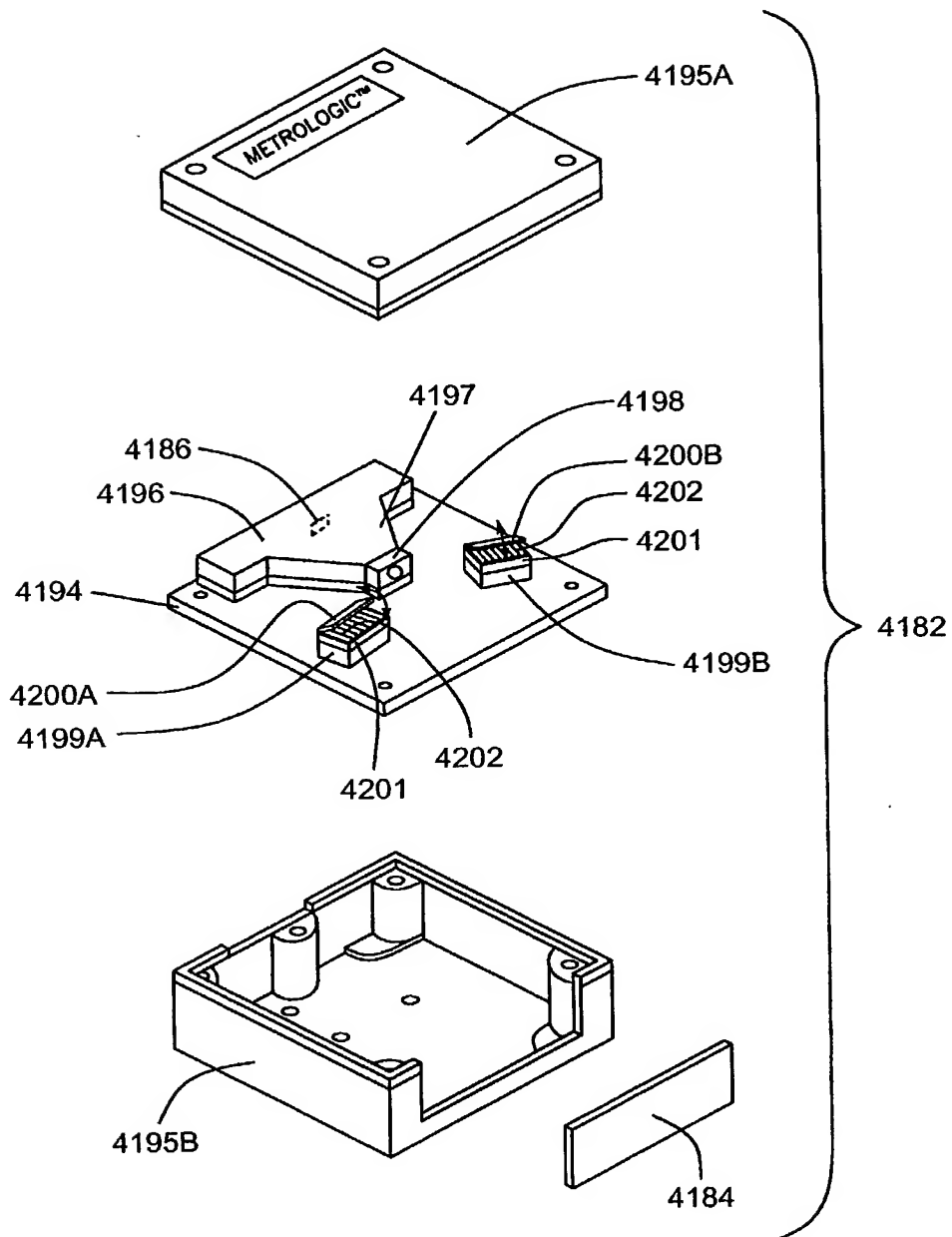


FIG. 58A

00/01+

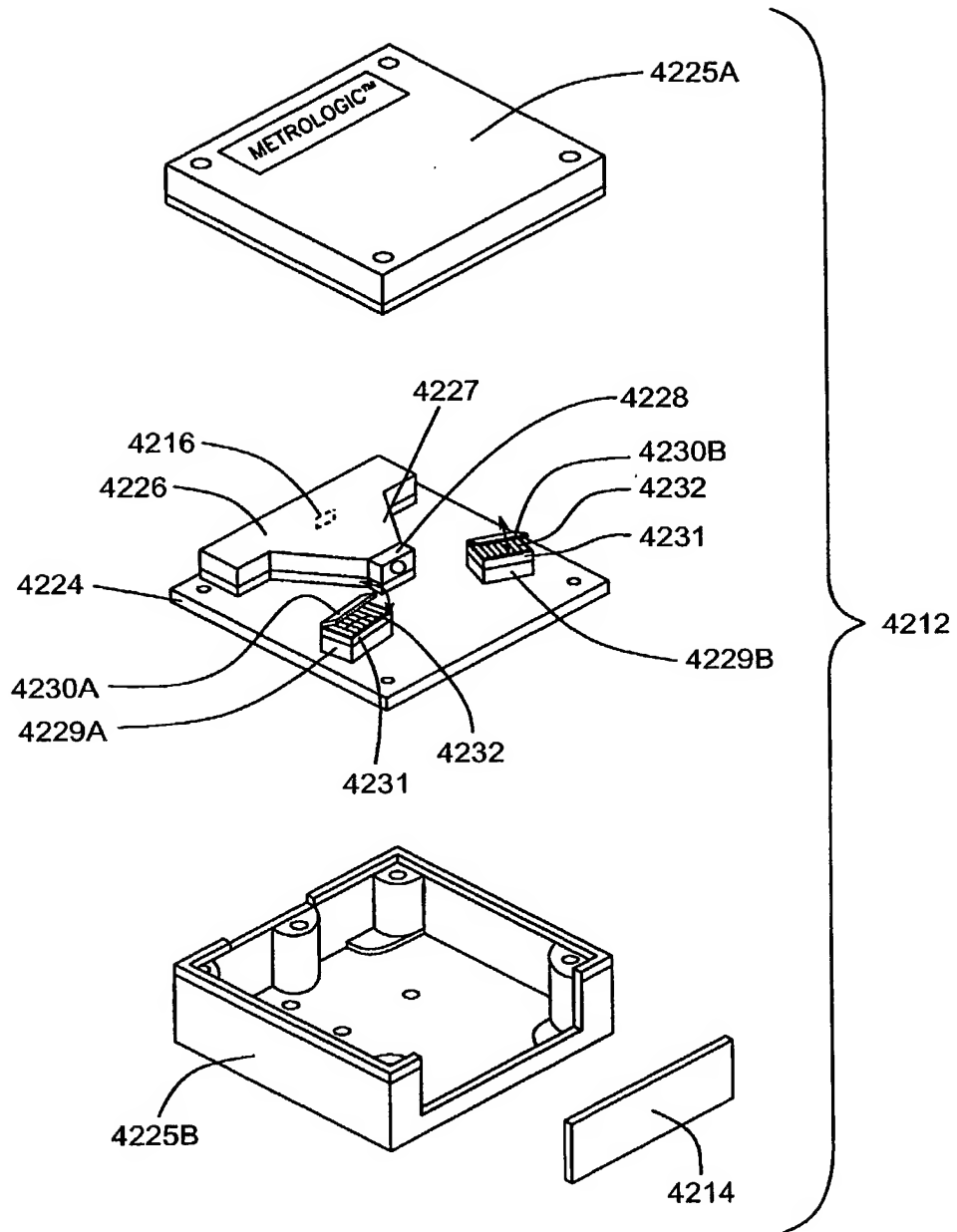


HS Optical Shutter  
Fig. 1114A-14B

FIG. 58B



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MLLD

Fig. 1115A-15B

FIG. 59B

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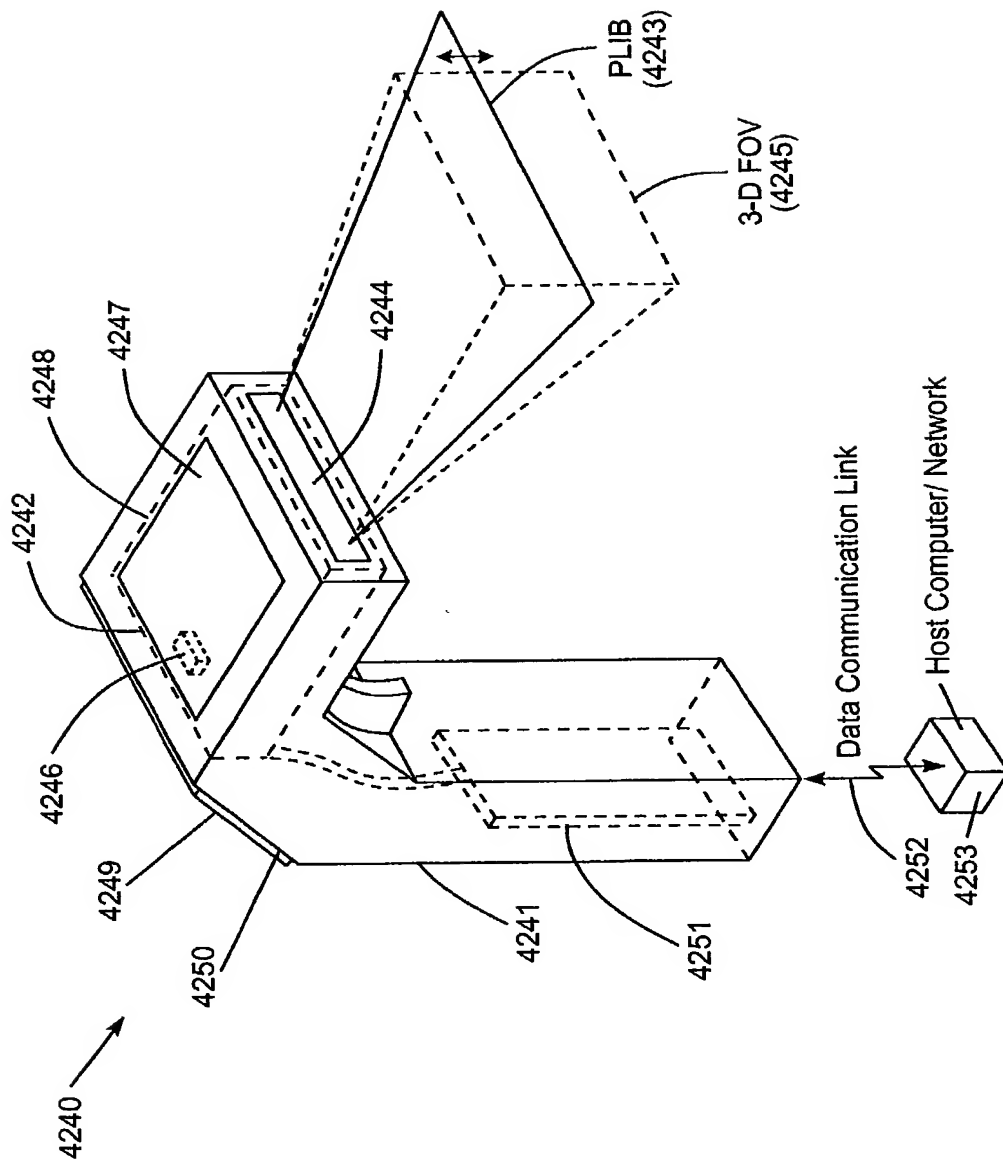
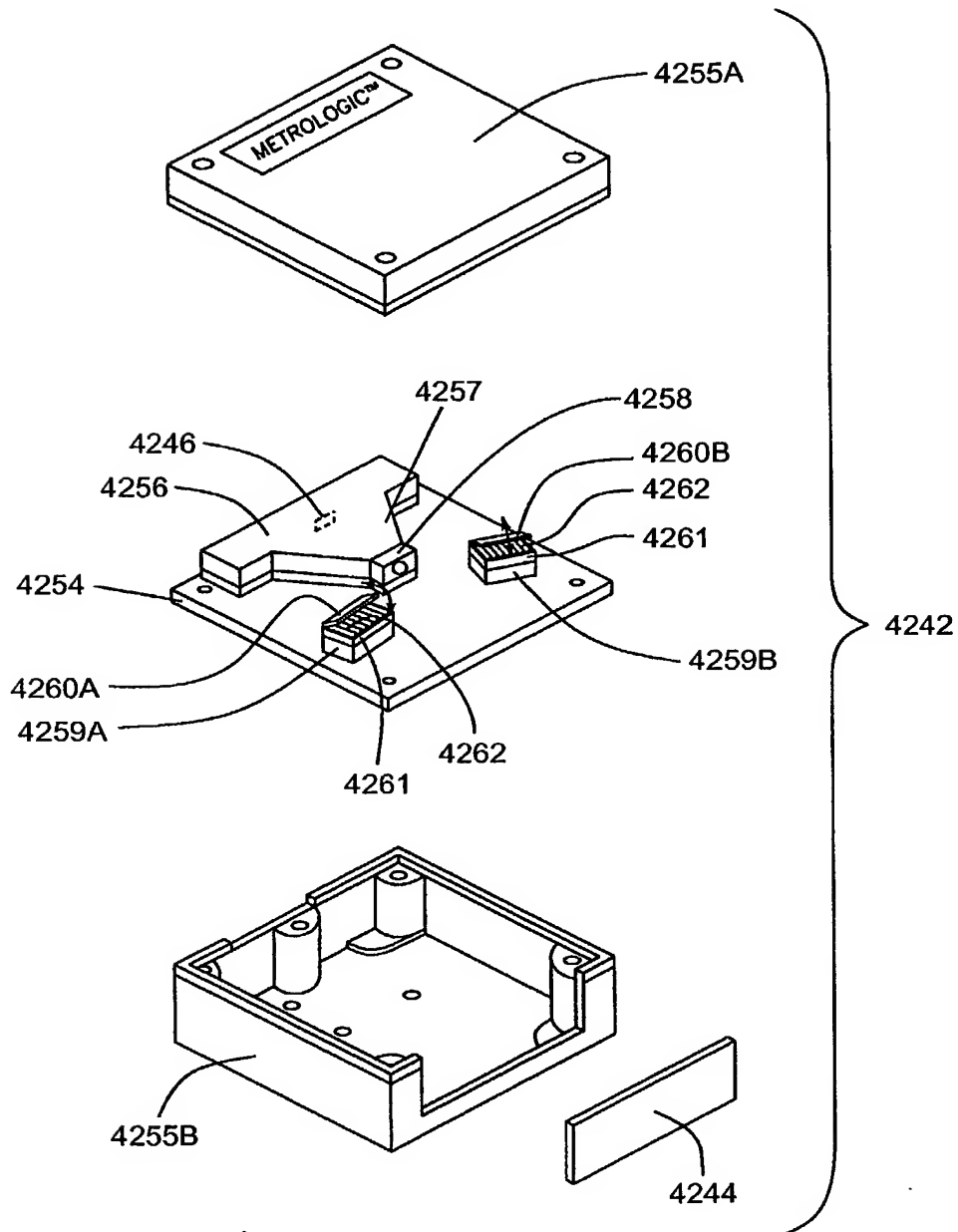


FIG. 60A



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Etalon (Temp. Phase Mod.)

Fig. 1117A-17B

FIG. 60B





760/000

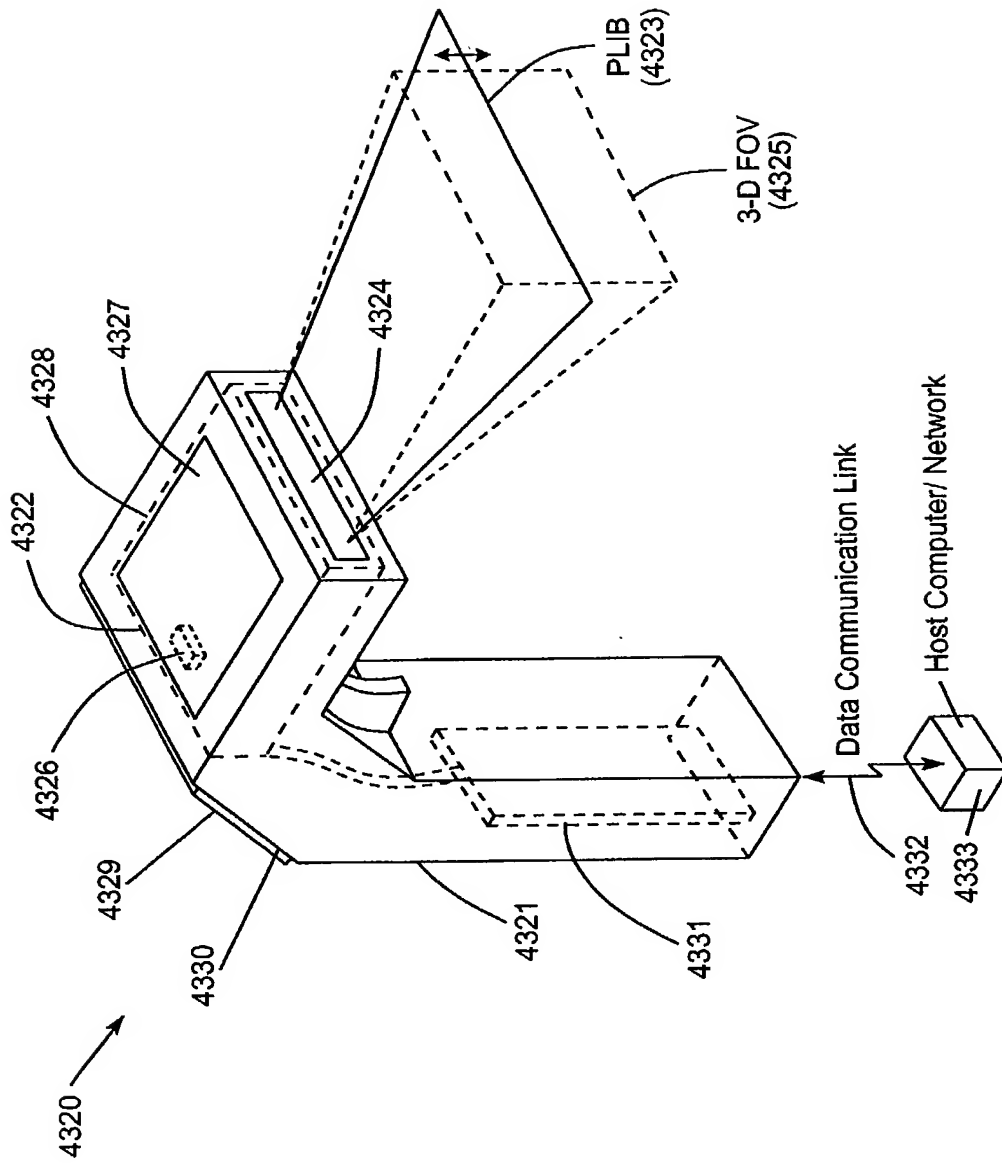
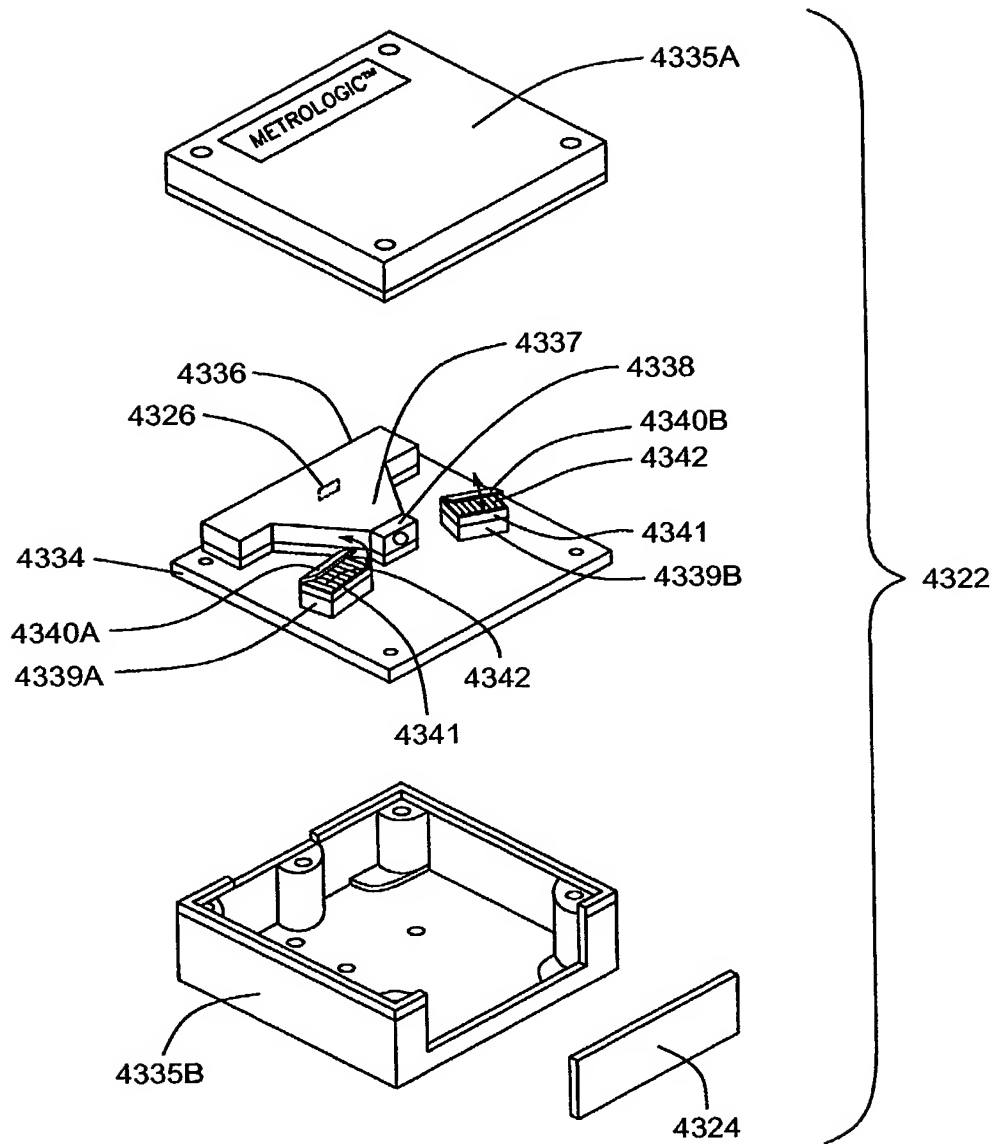


FIG. 62A

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Micro-oscillating  
Spatial Intensity  
Modulation Panels  
Fig. 1121A-21D

FIG. 62B

FIG. 63A

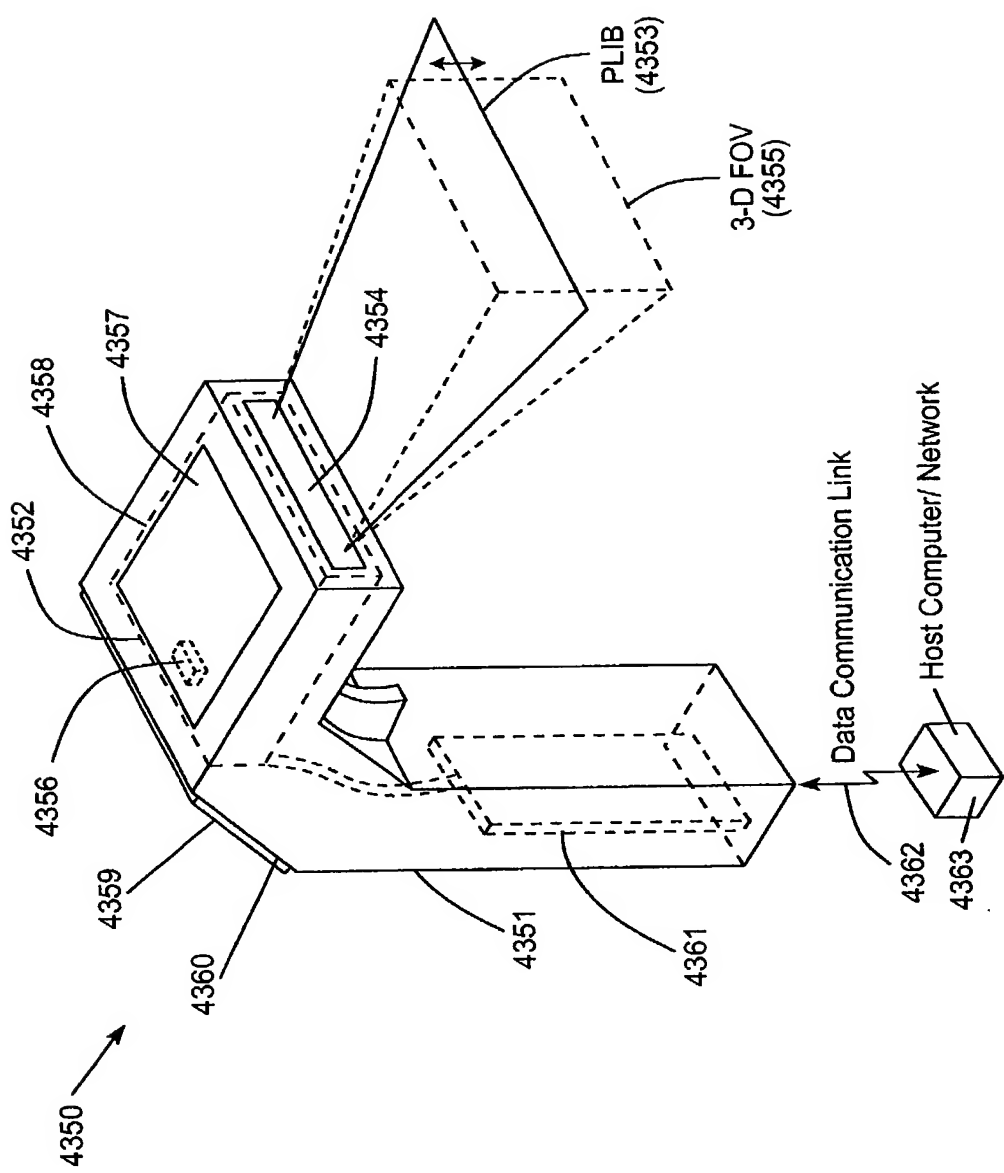
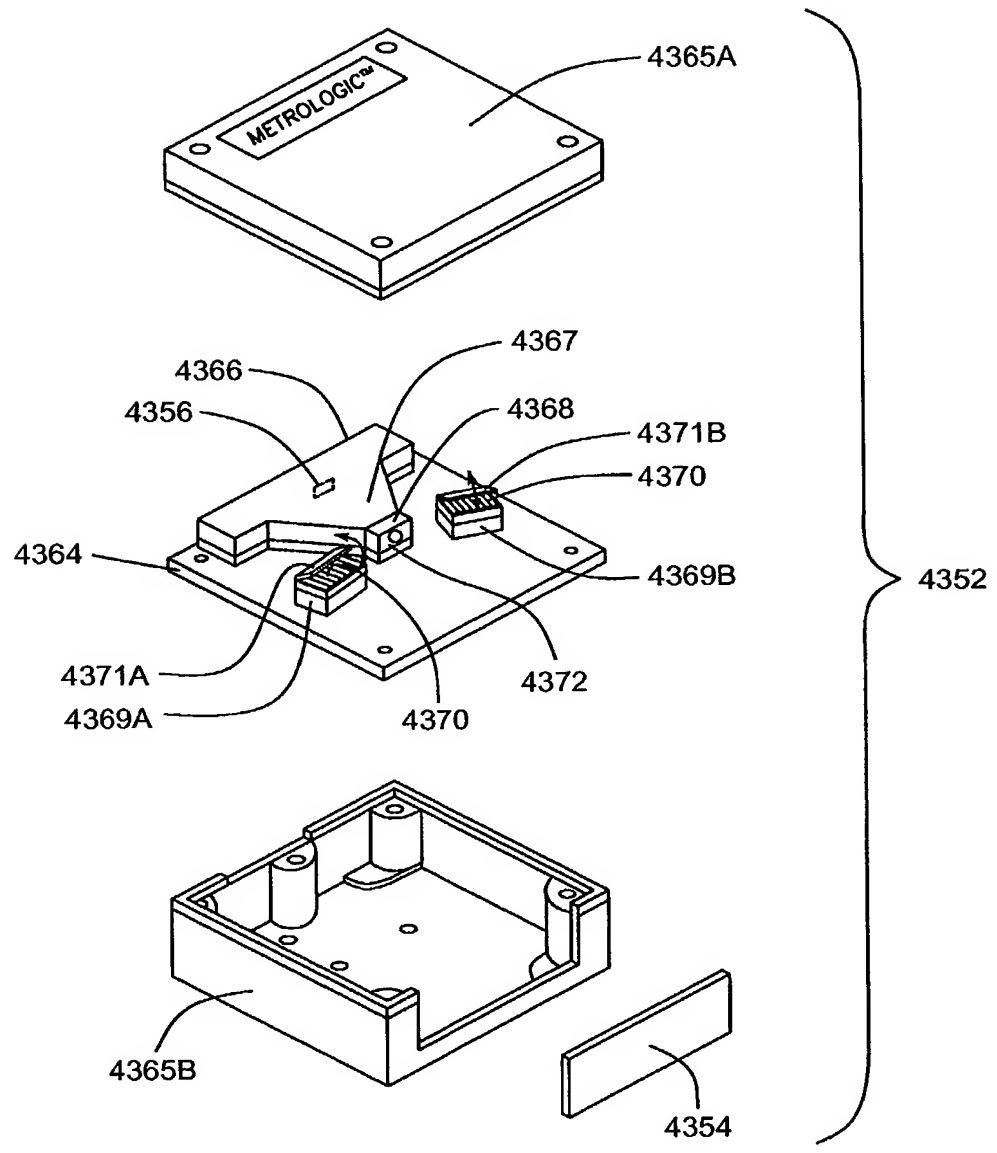


FIG. 63A

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EO or Mechanically  
Rotating Iris  
Fig. 1123A-23B

FIG. 63B



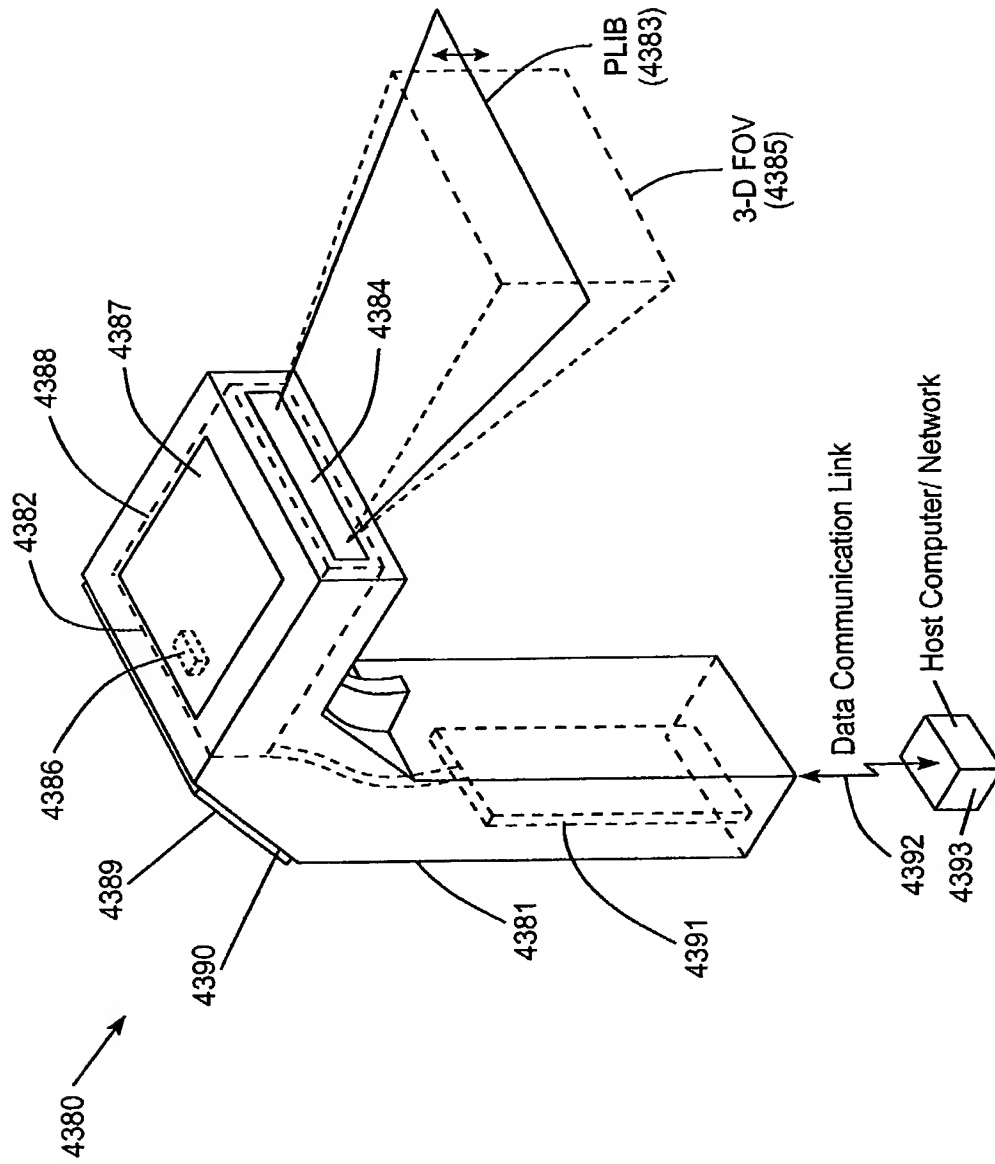
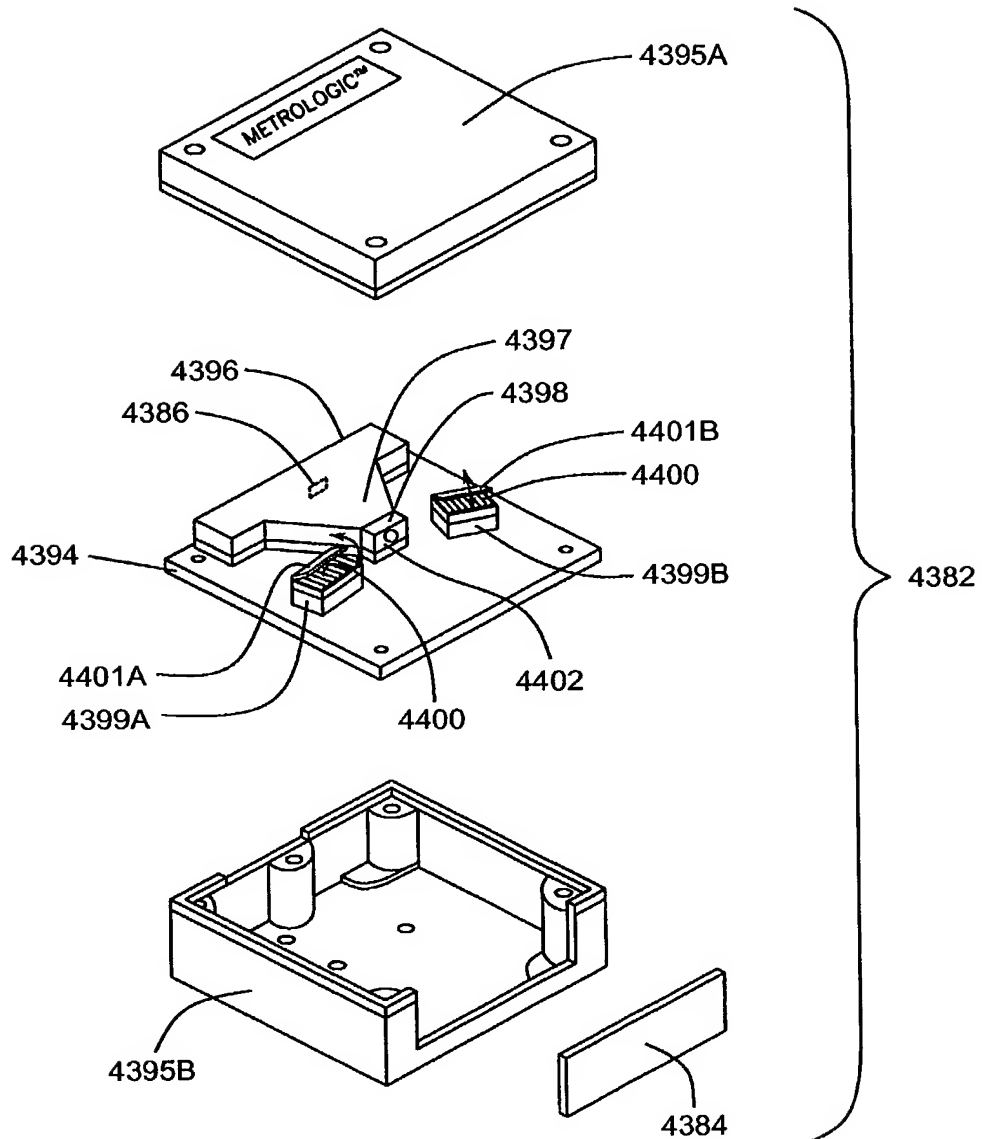


FIG. 64A



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E-optical Shutter  
Before IFD Lens  
Fig. 1124A

FIG. 64B

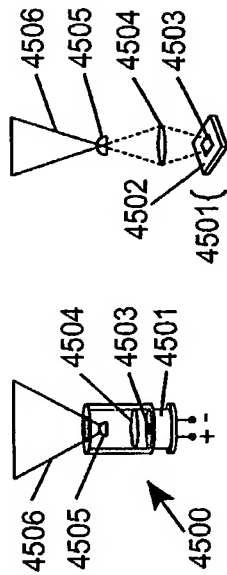


FIG. 65A

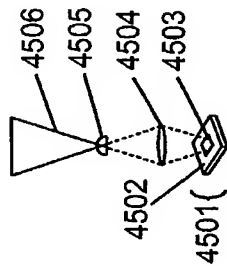


FIG. 65B

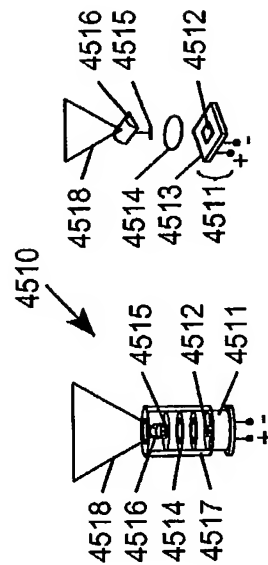


FIG. 66A

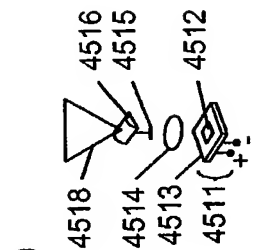


FIG. 66B

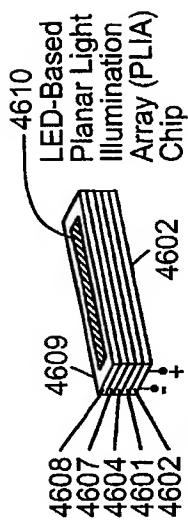


FIG. 67A

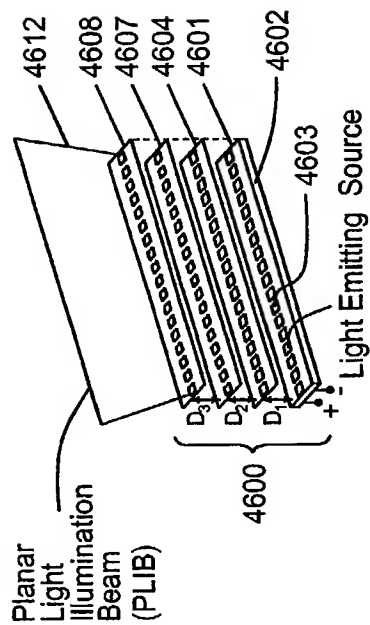


FIG. 67B

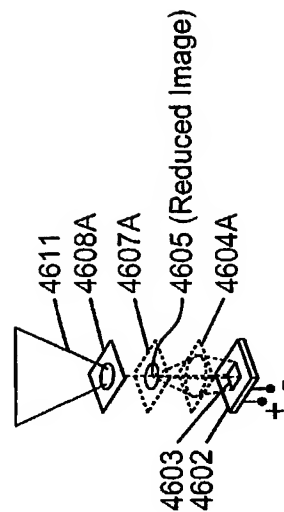


FIG. 67C

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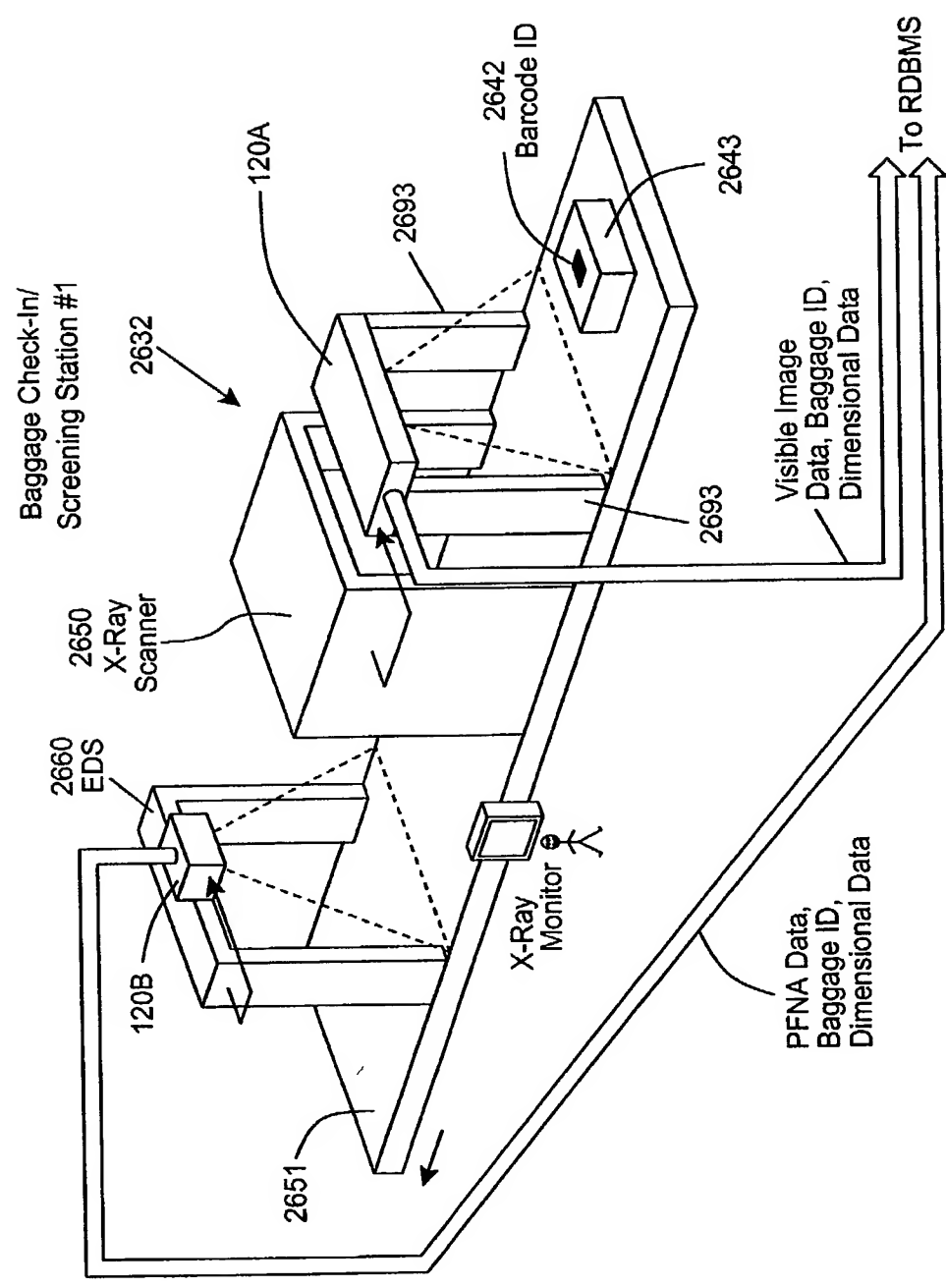
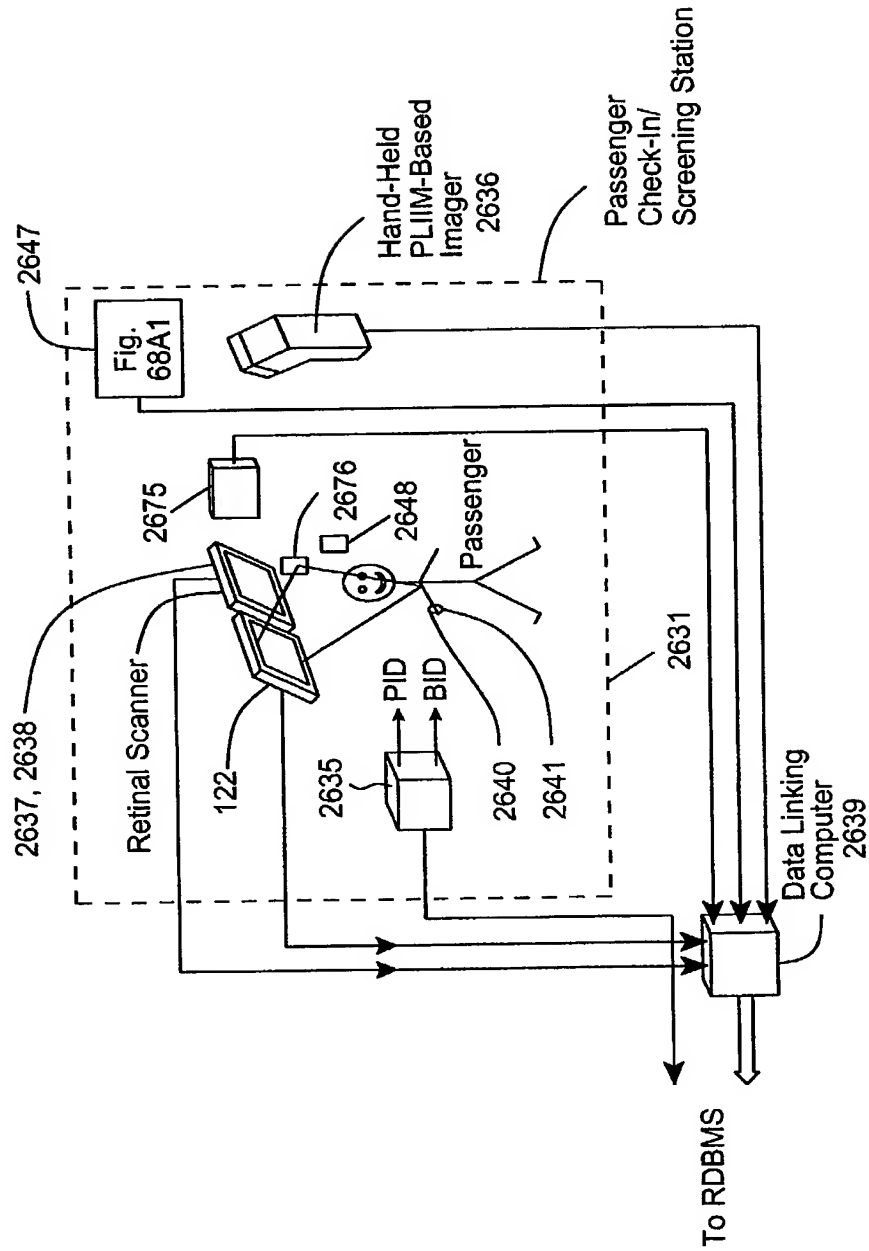


FIG. 68-1



**FIG. 68-2**



**FIG. 68-3**

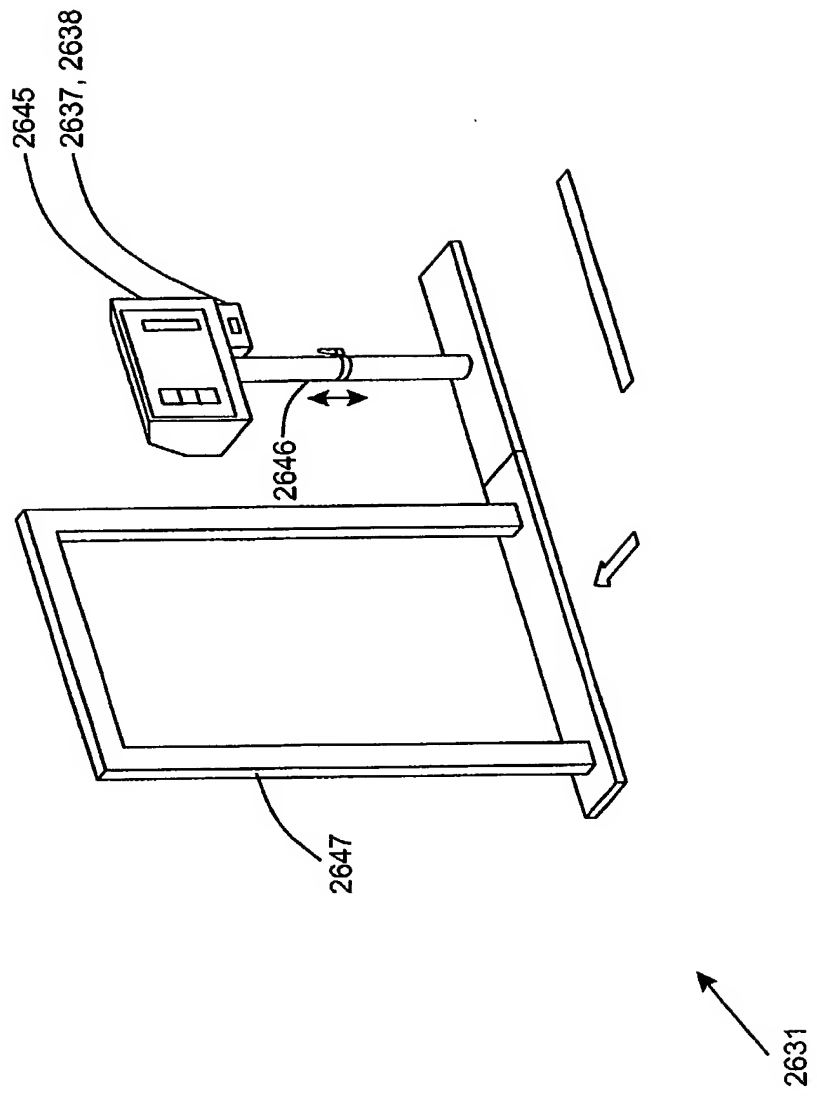


FIG. 68A

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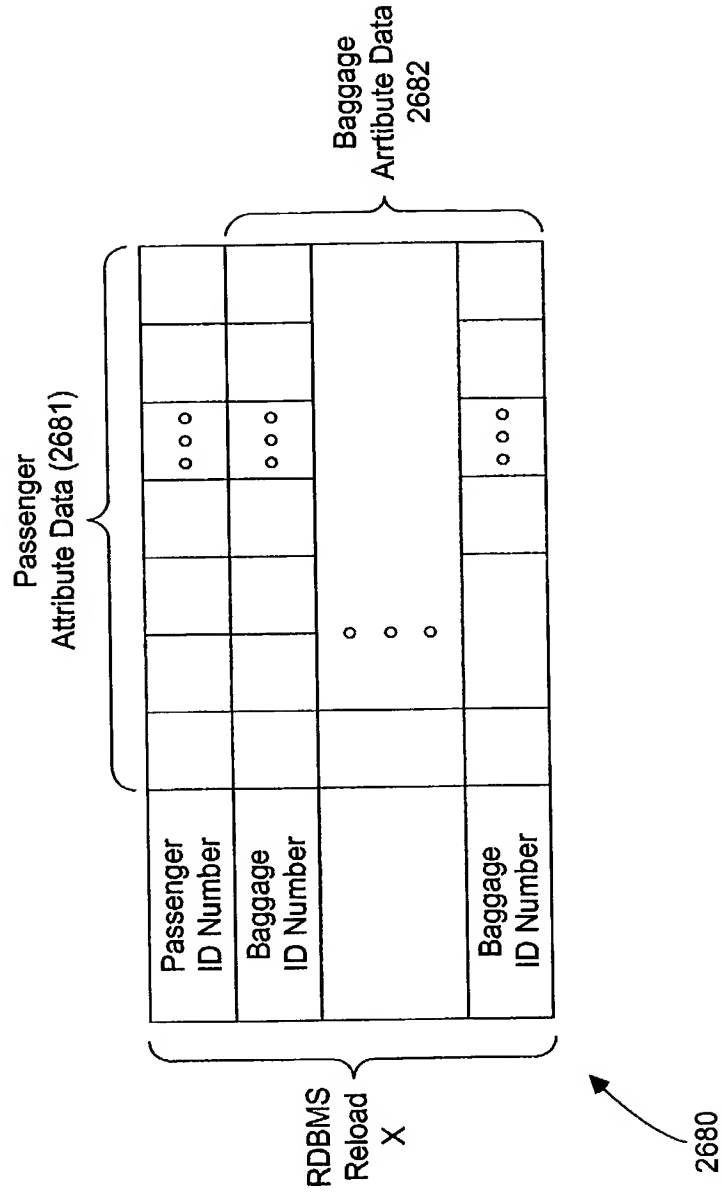


FIG. 68B

FIG. 68C1

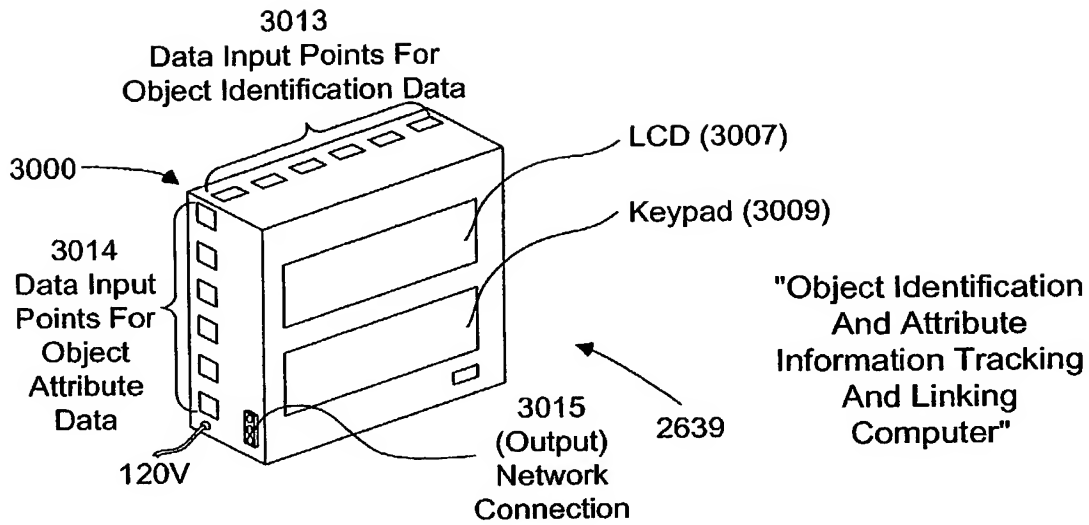


FIG. 68C1

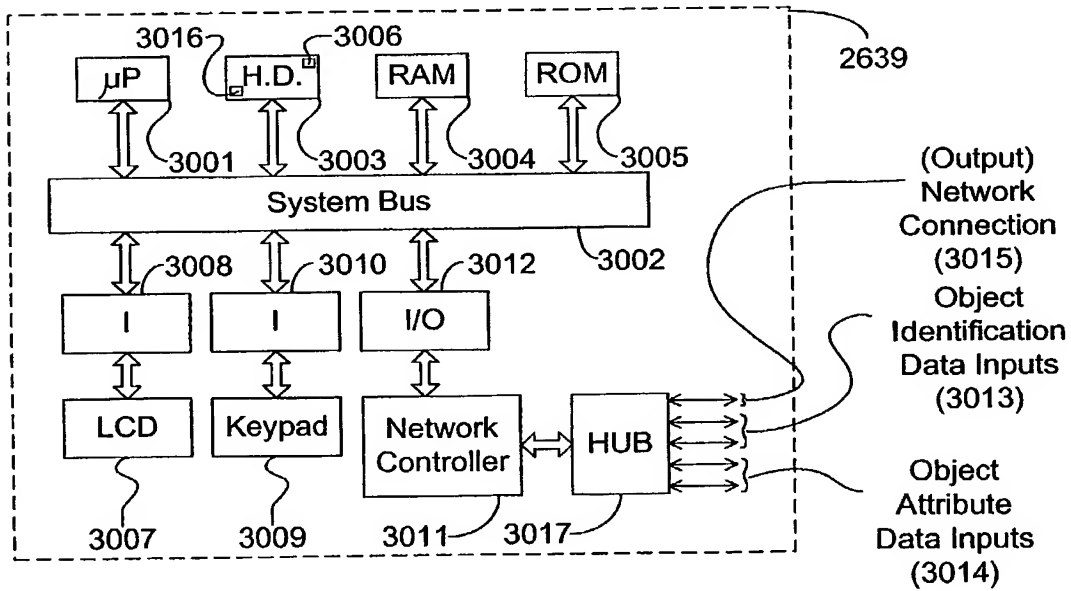


FIG. 68C2



# Object Identification And Attribute Information Tracking And Linking Computer System

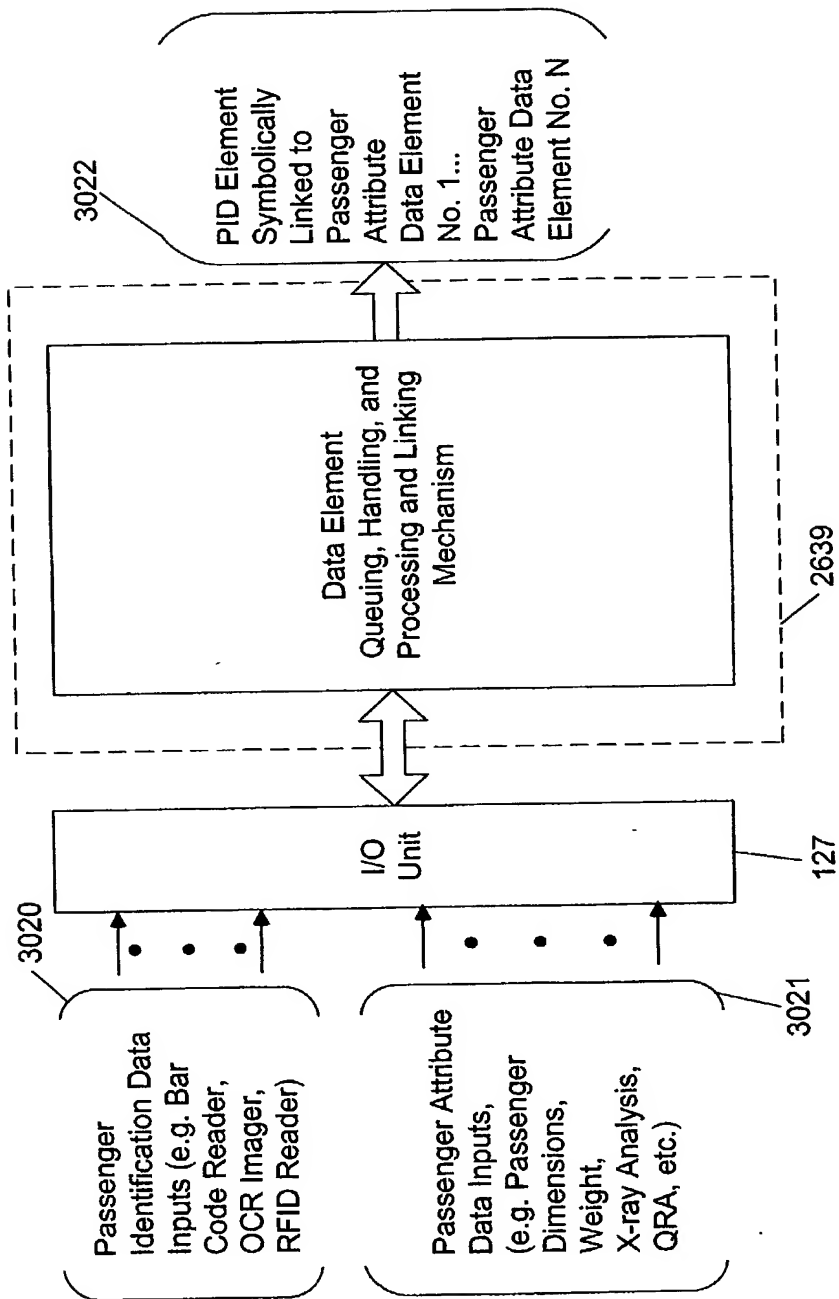


FIG. 68C3

FIG. 68C3

# Data Element Queuing, Handling, And Processing Subsystem Employed In The Object Identification And Attribute Acquisition System Of The Present Invention. (131)

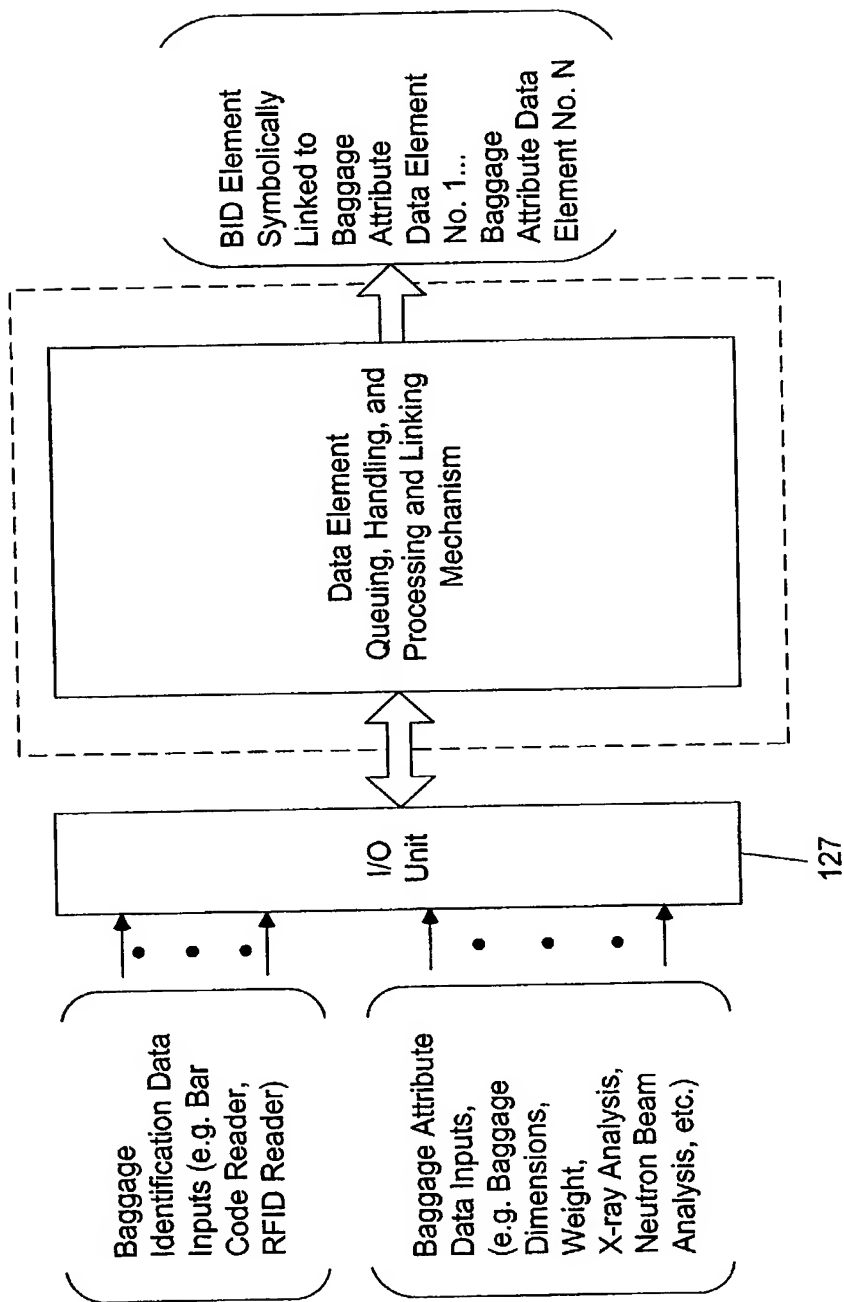


FIG. 68C4

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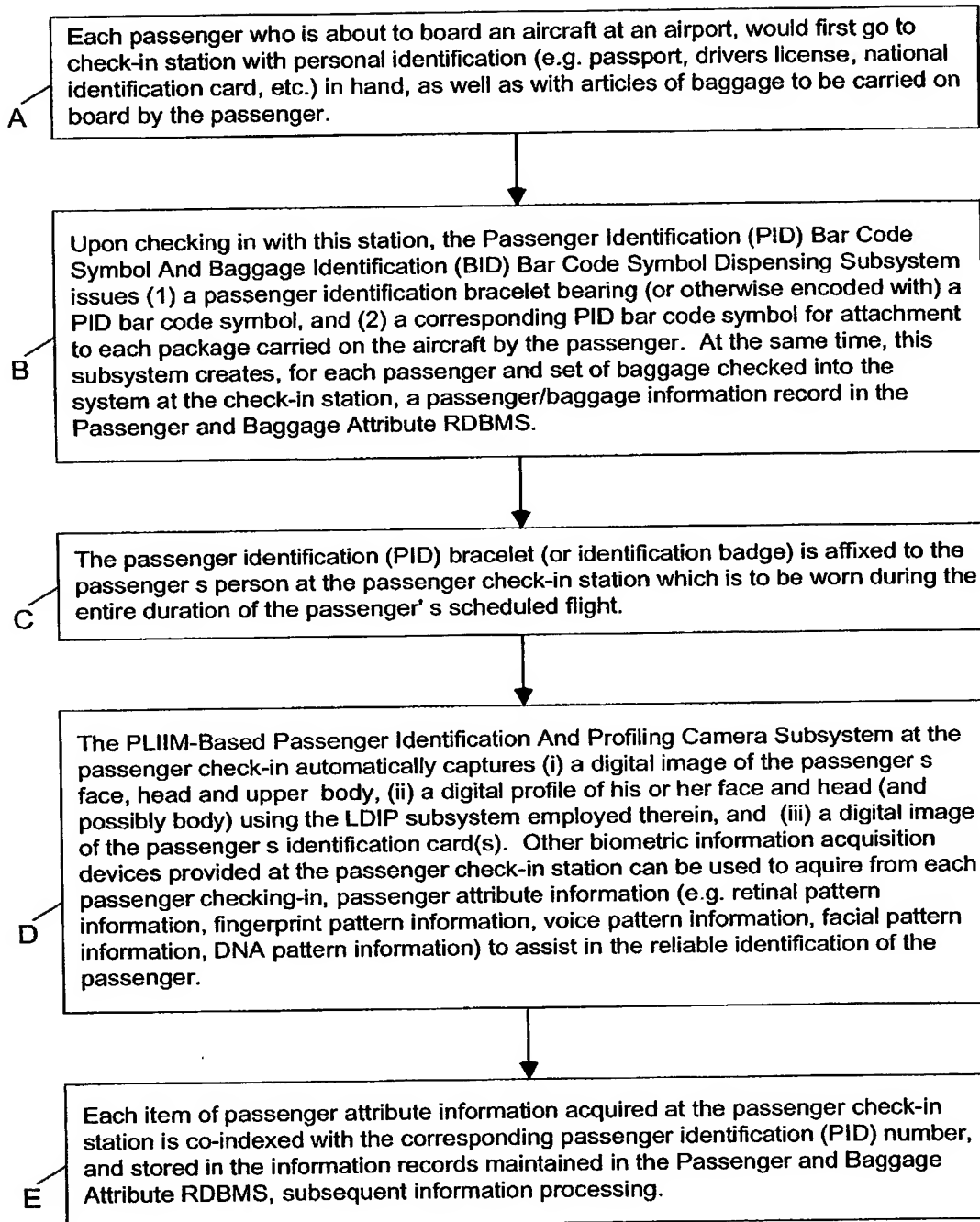


FIG. 68D1

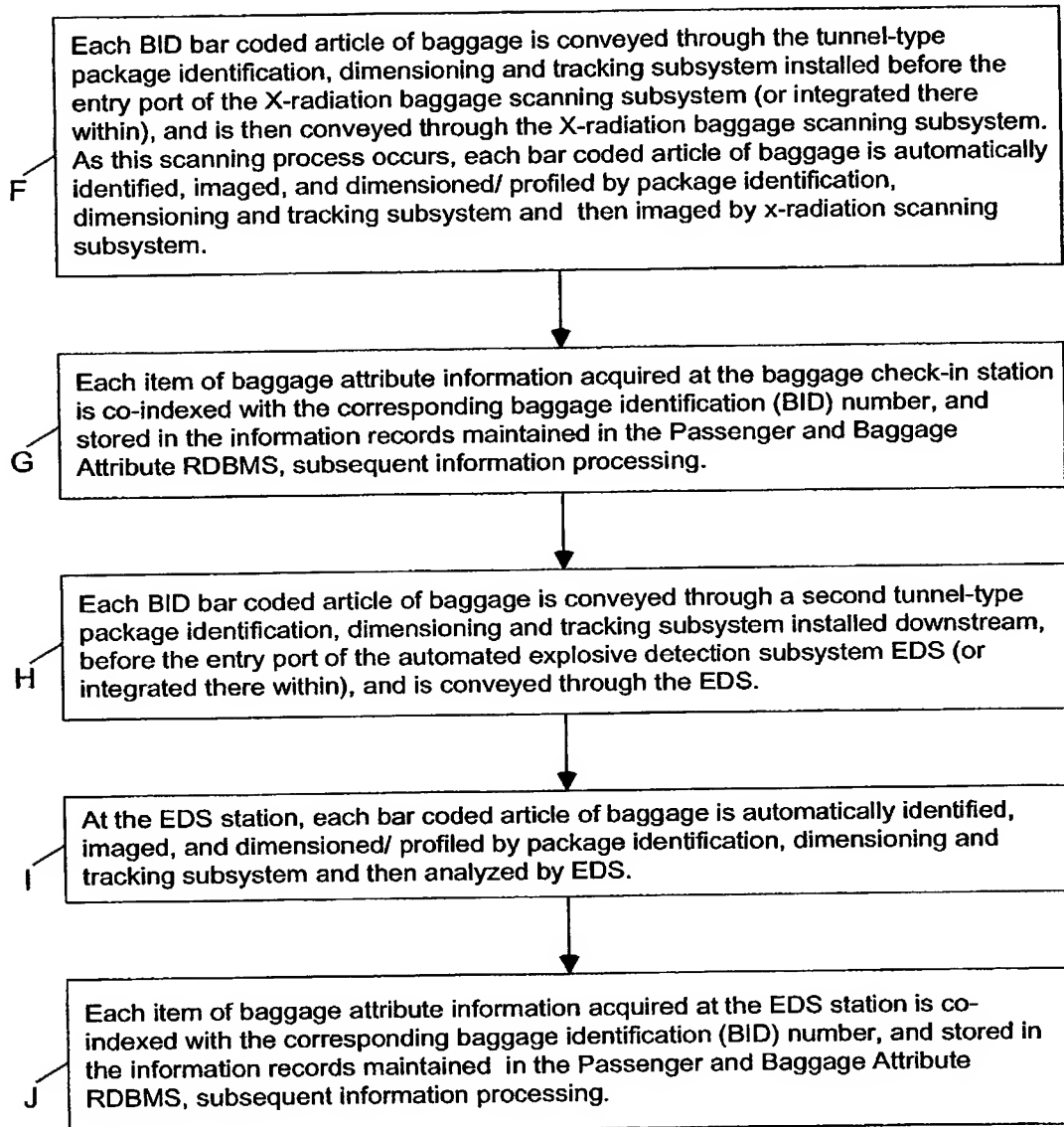


FIG. 68D2

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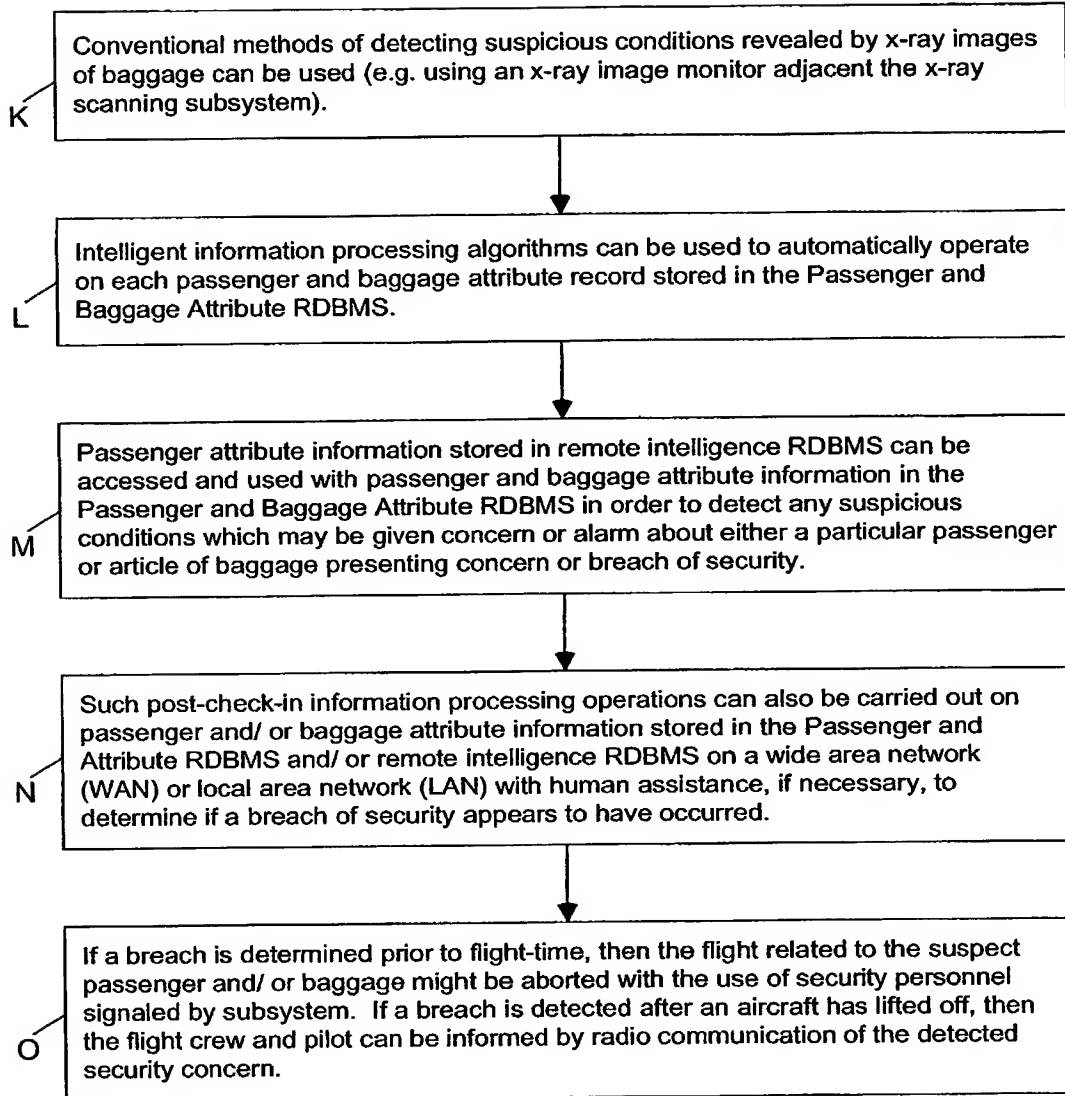


FIG. 68D3

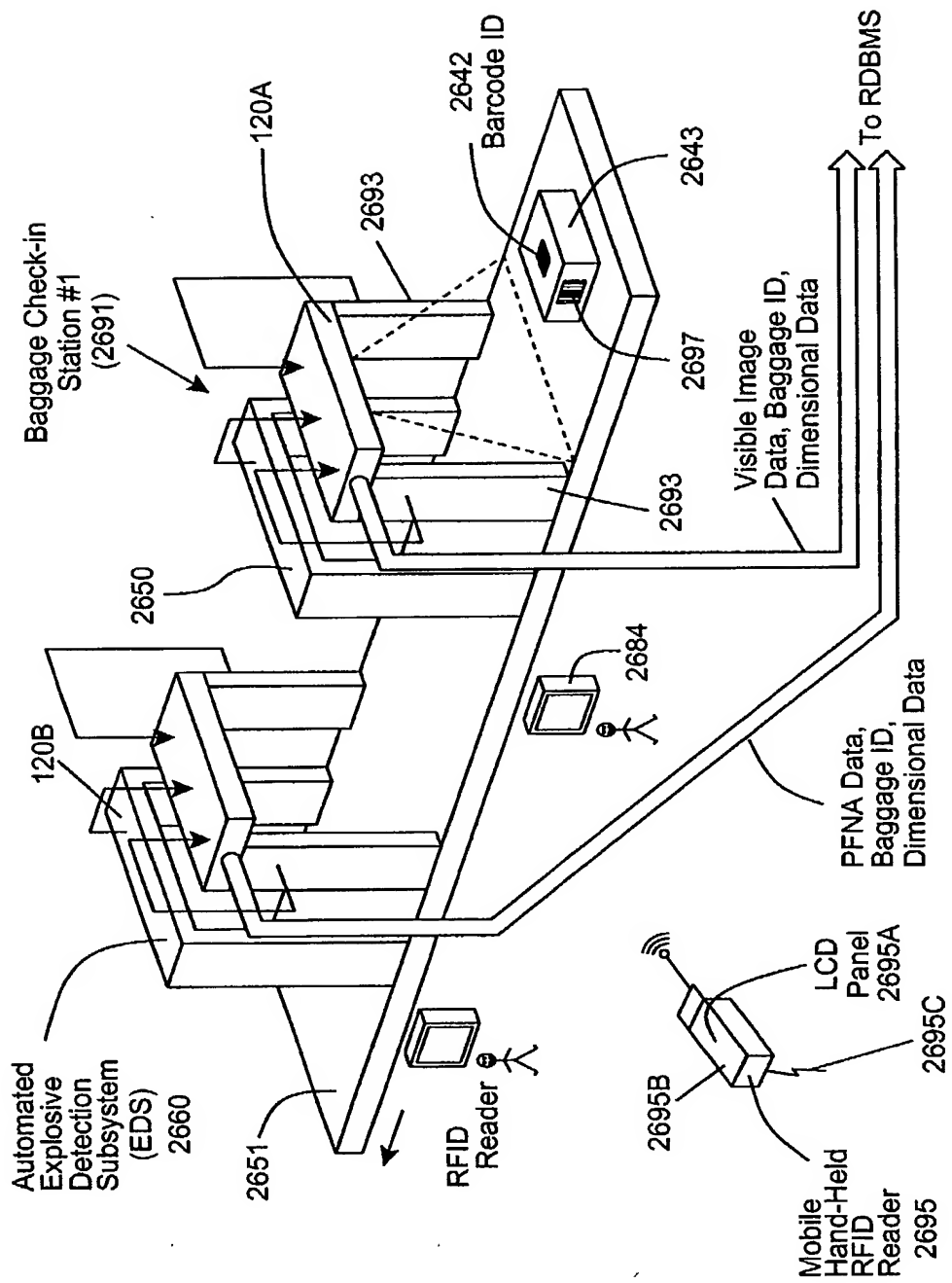


FIG. 69-1

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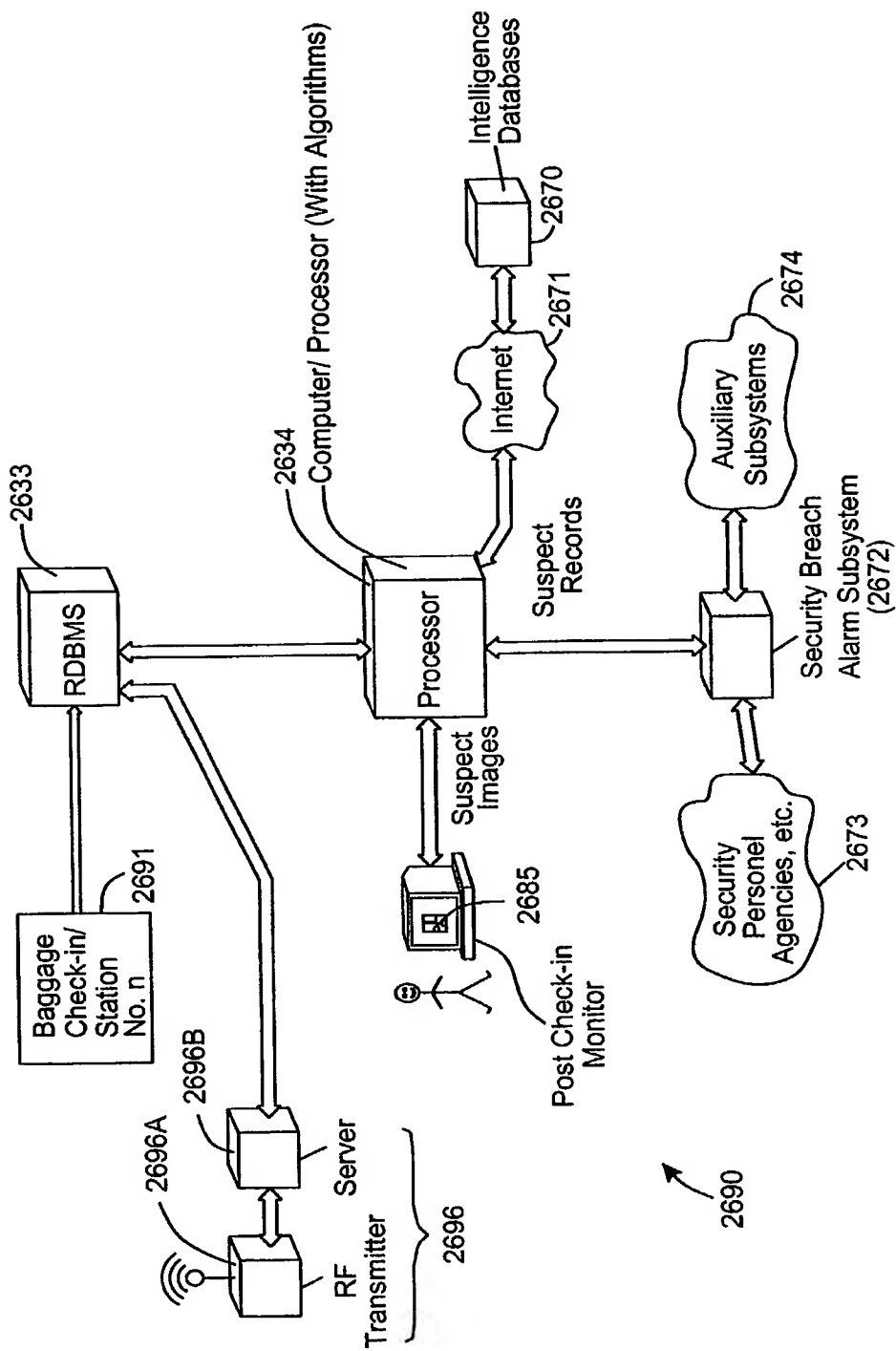


FIG. 69-2

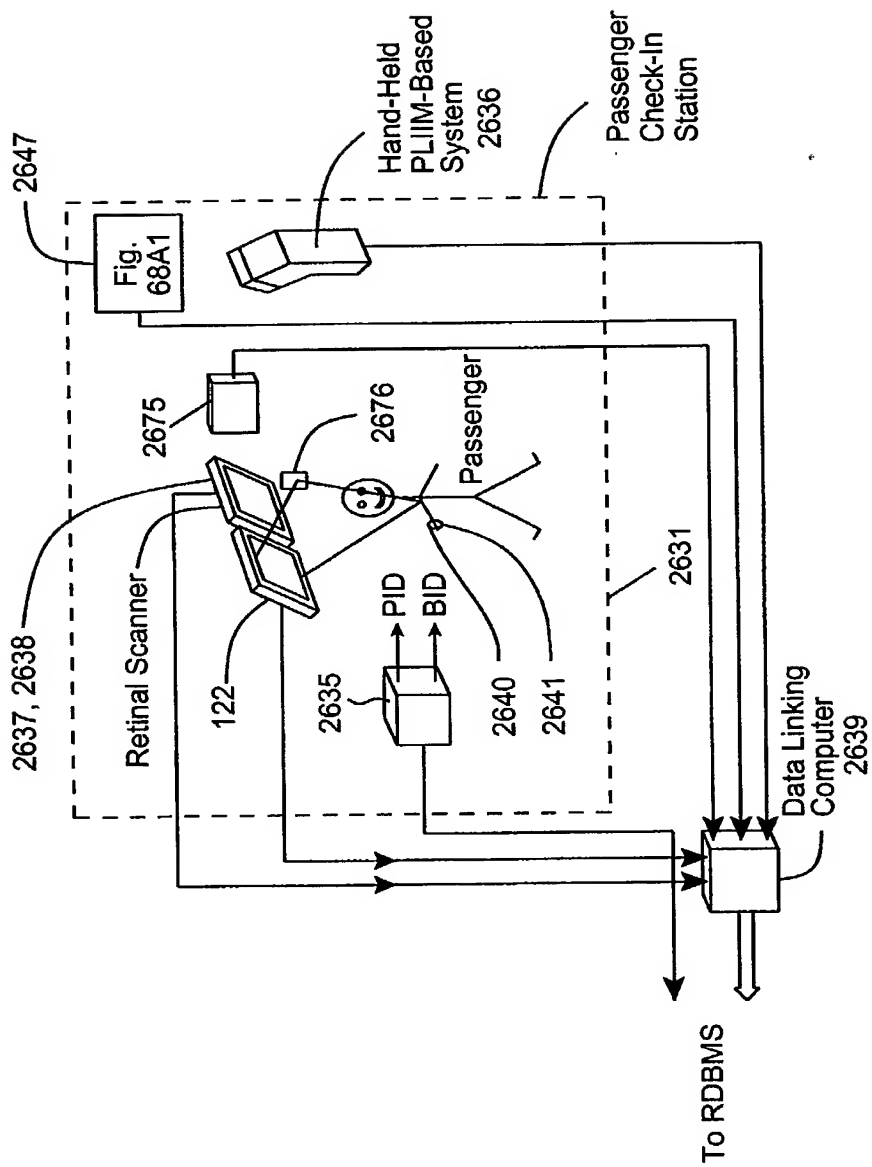


FIG. 69-3



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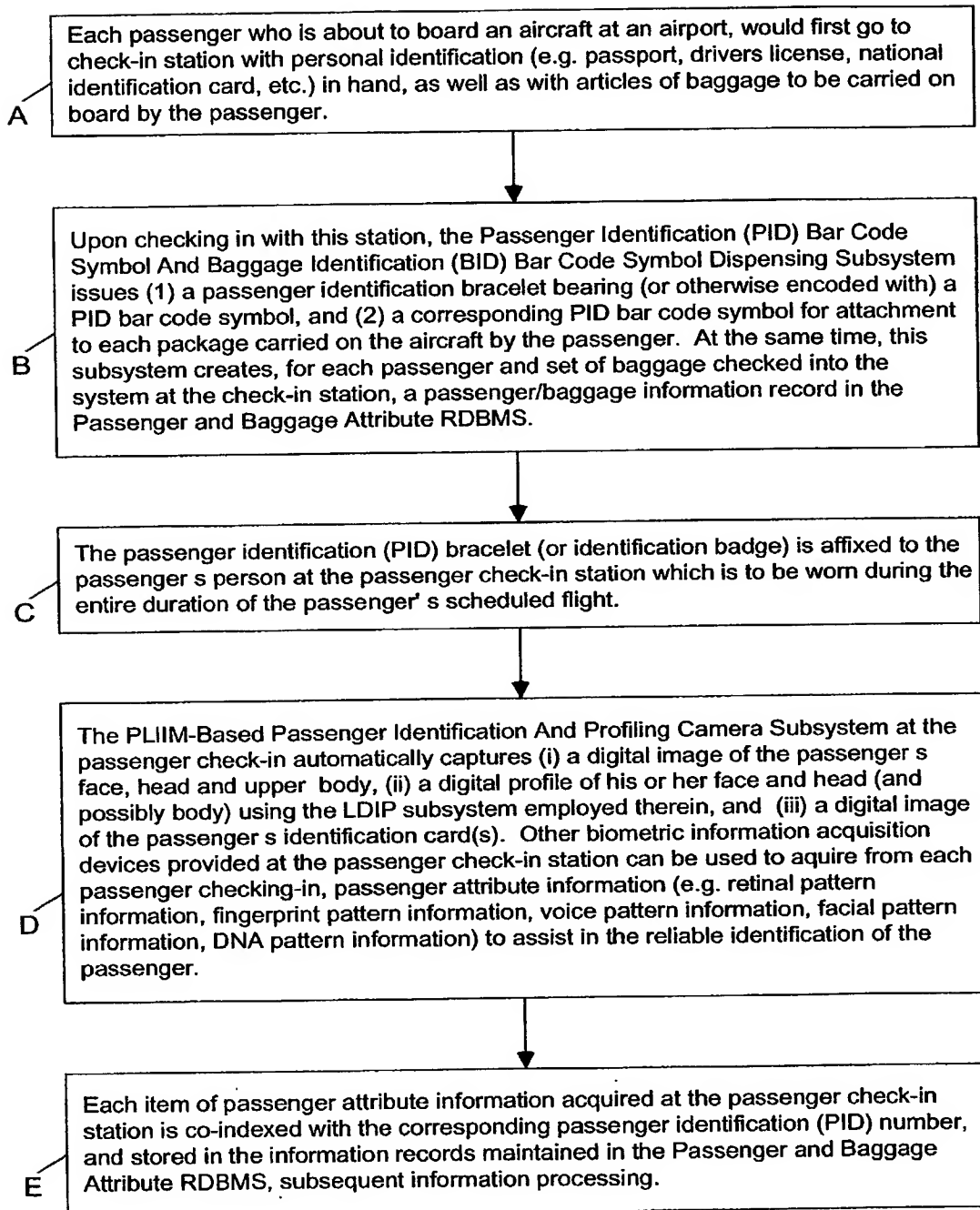


FIG. 69B1



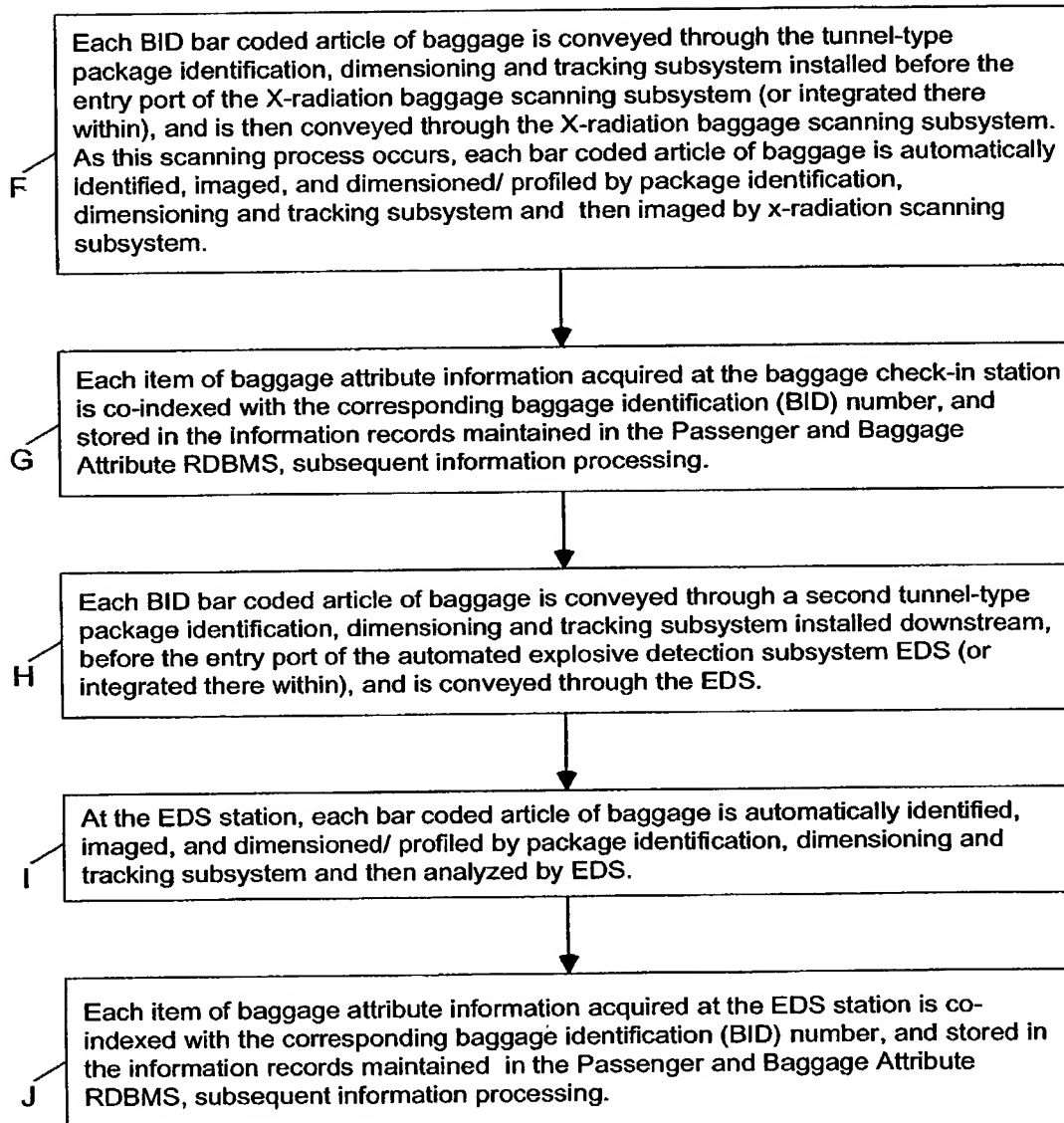


FIG. 69B2

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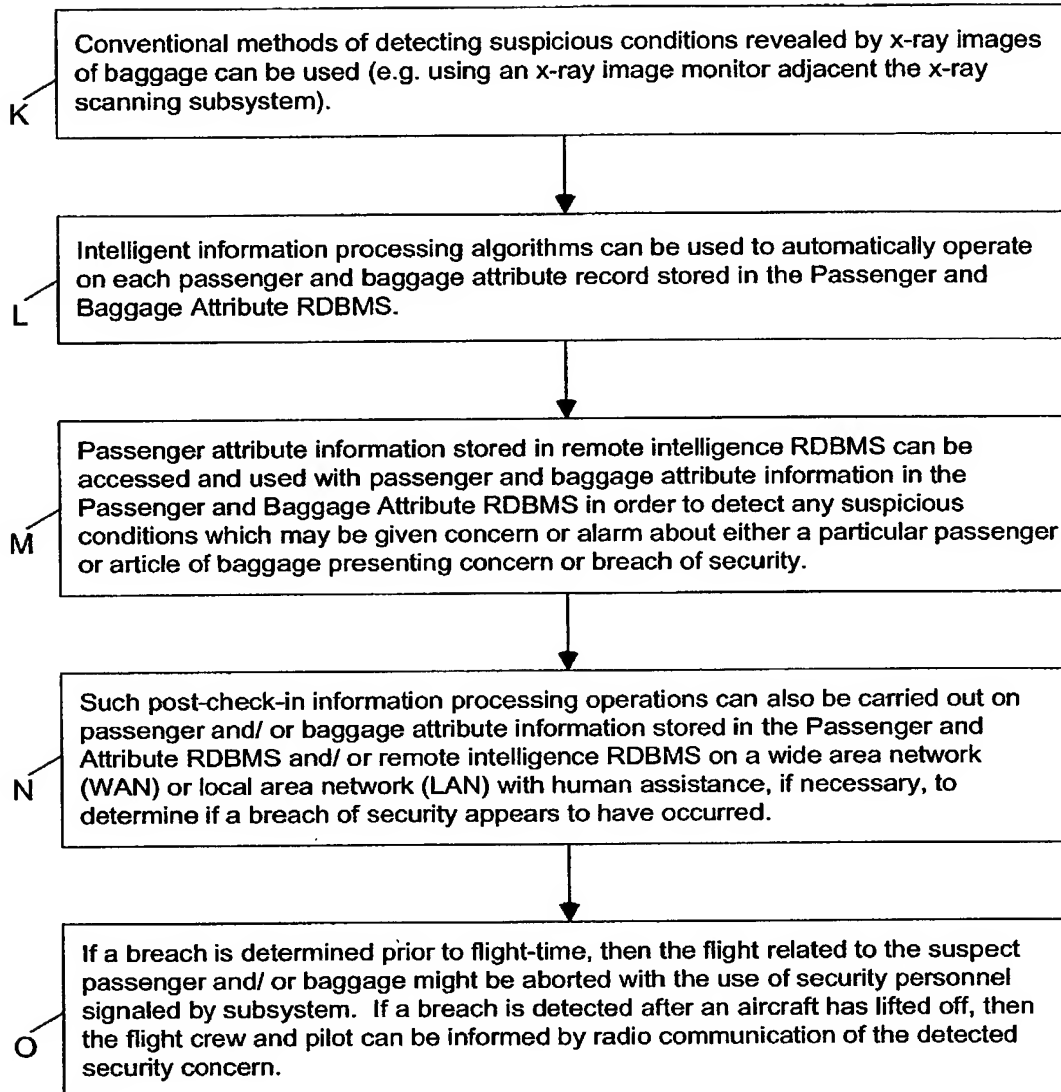


FIG. 69B3

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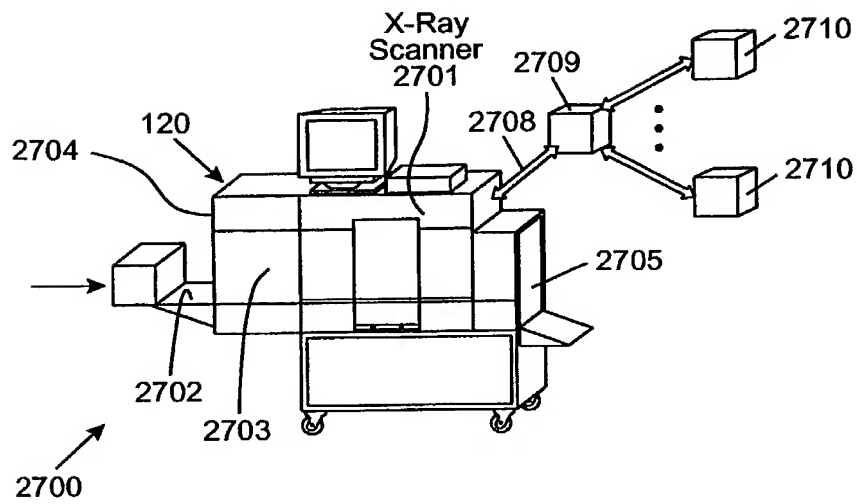


FIG. 70A

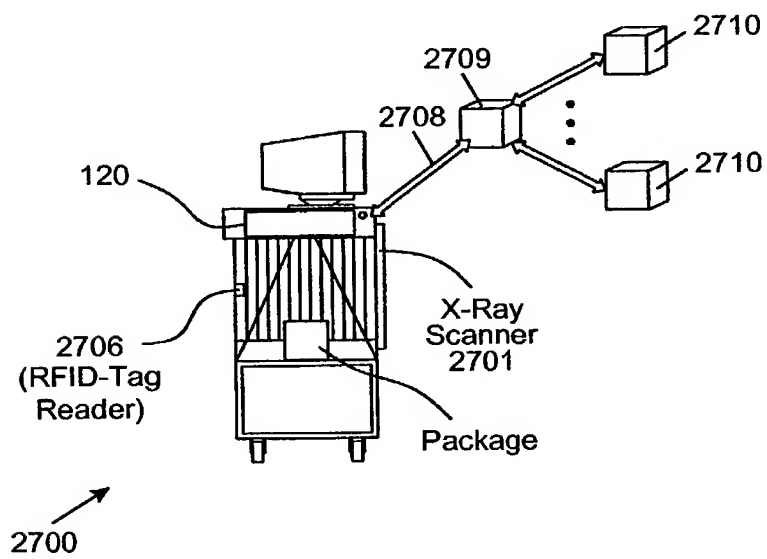


FIG. 70B

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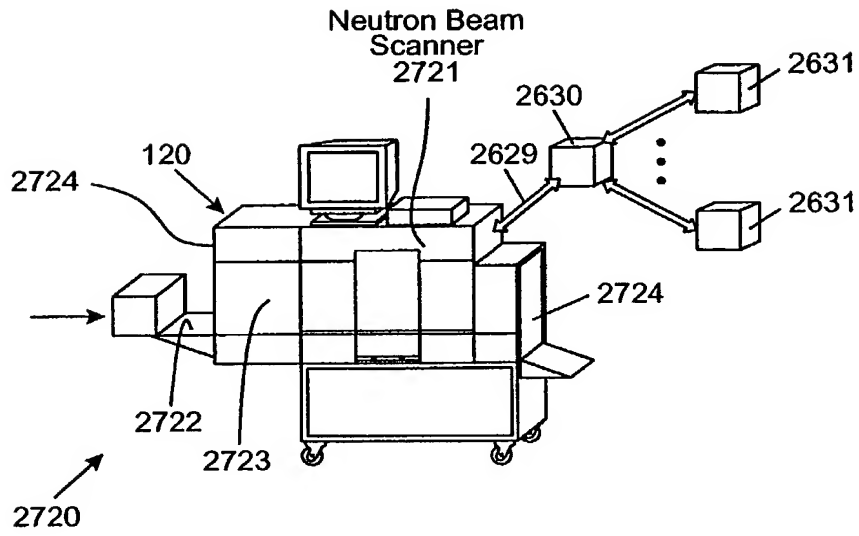


FIG. 71A

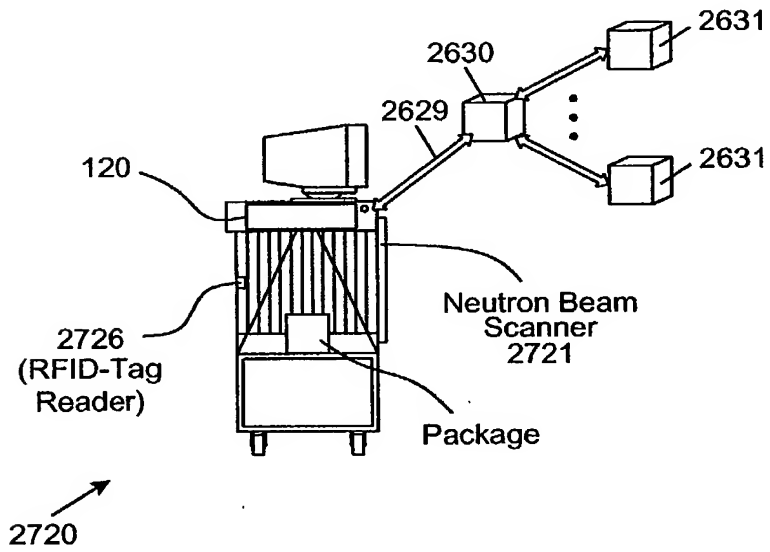


FIG. 71B

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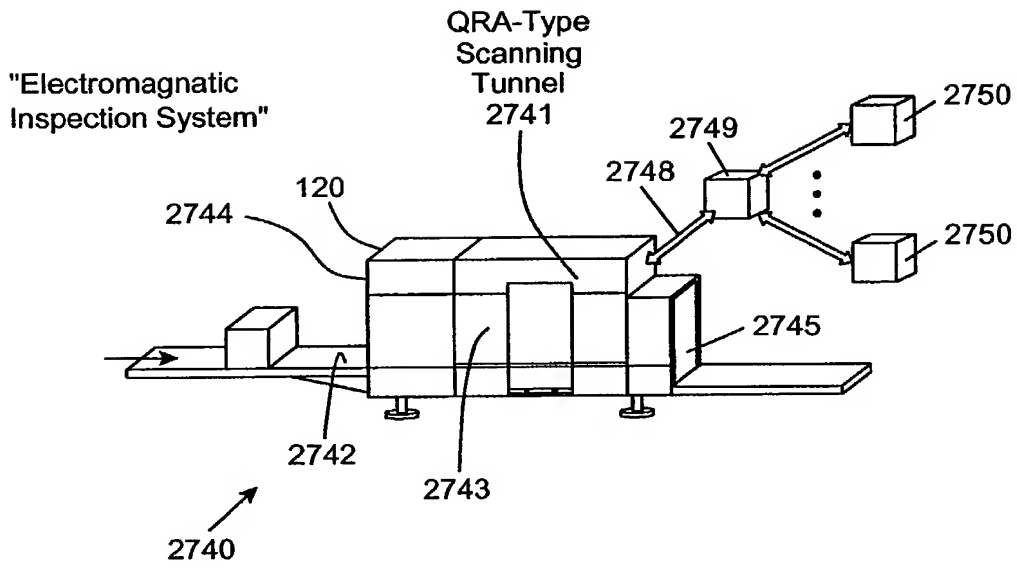


FIG. 72A

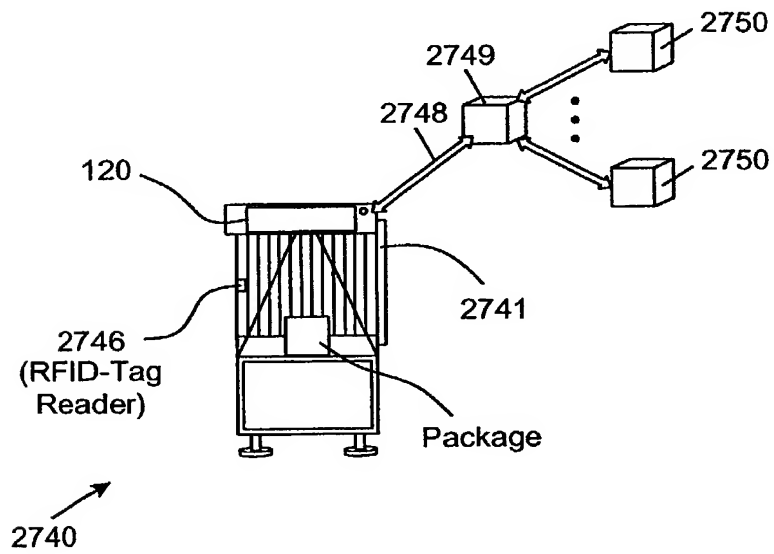


FIG. 72B

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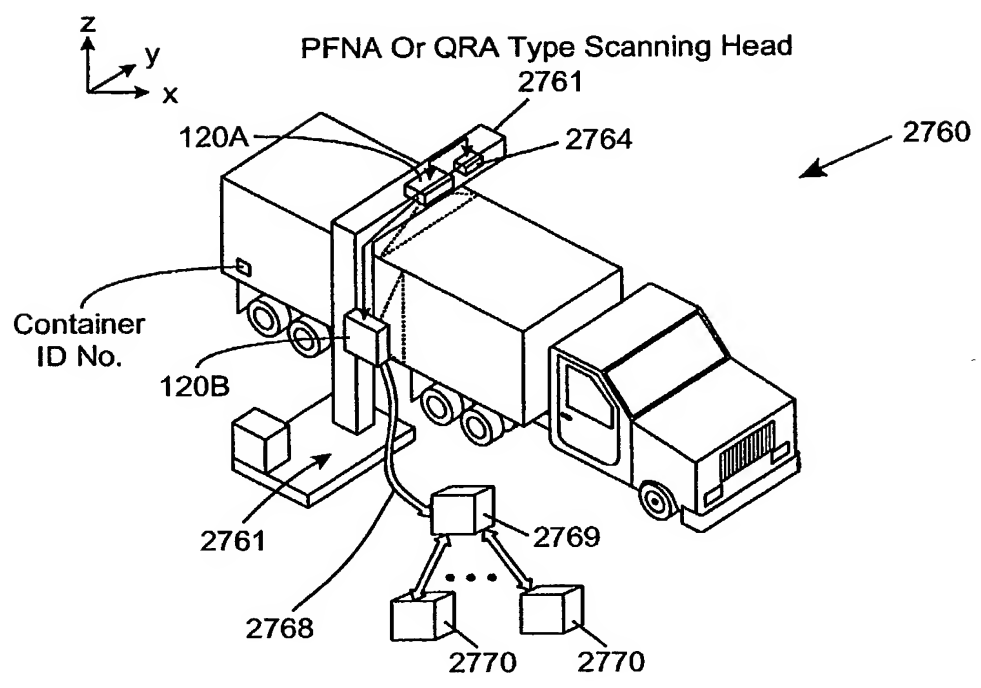


FIG. 73

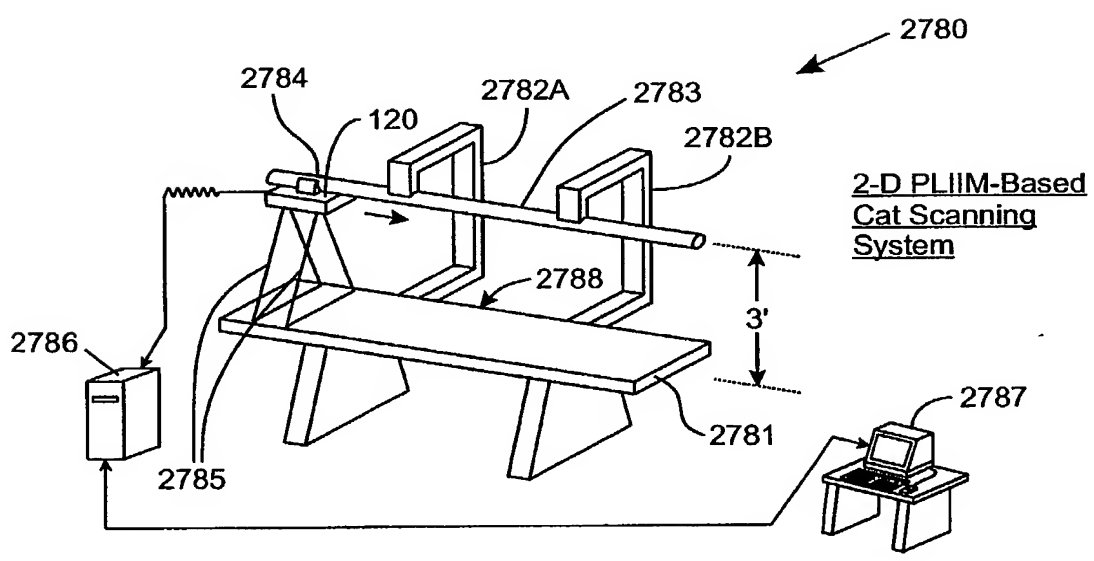


FIG. 74





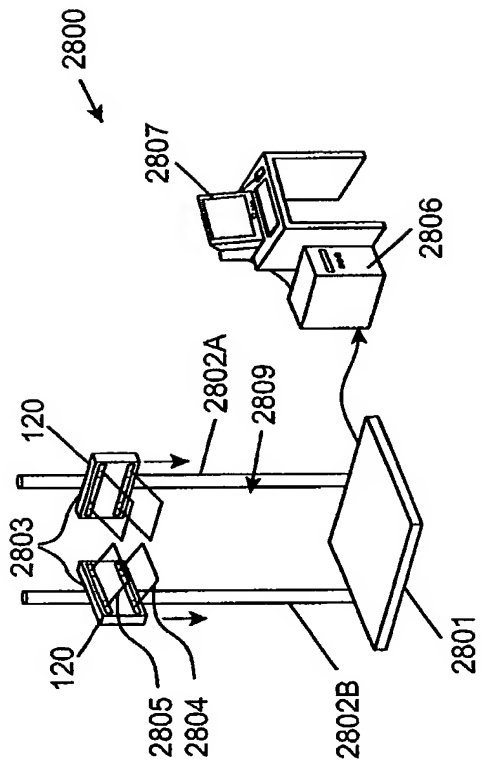


FIG. 76

"3-D Hand-Supportable  
Mobile Digitizer"  
2810

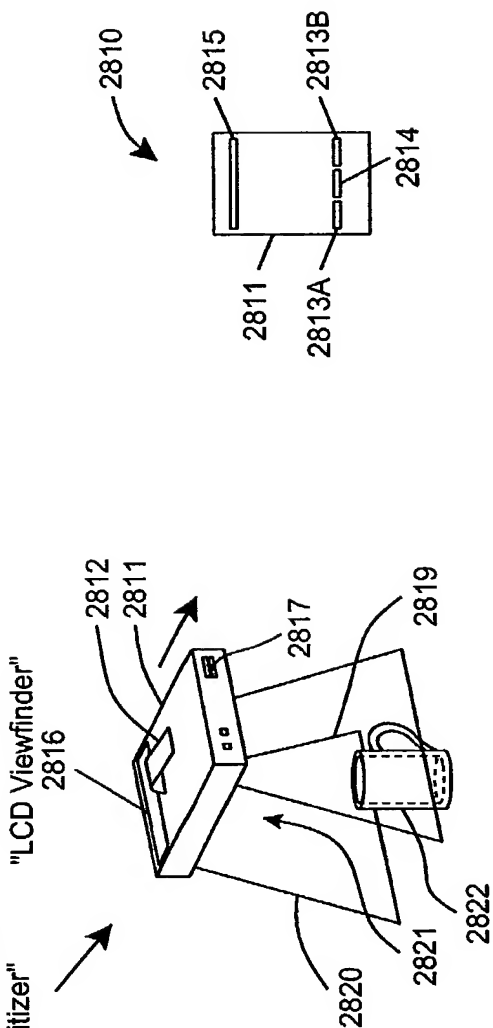


FIG. 77A

FIG. 77B

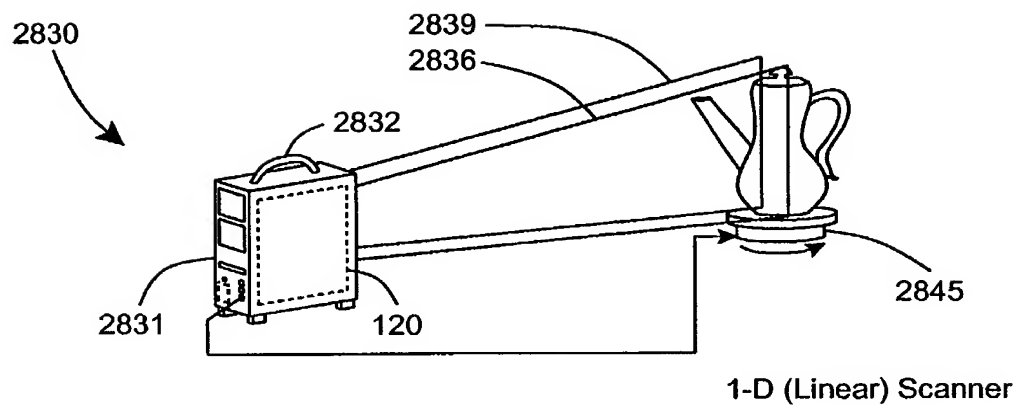


FIG. 78A

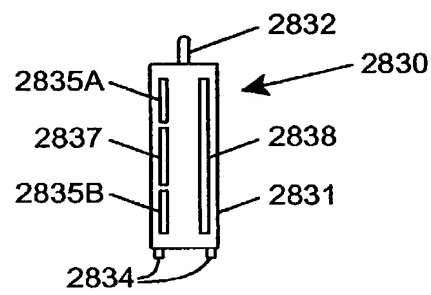


FIG. 78B

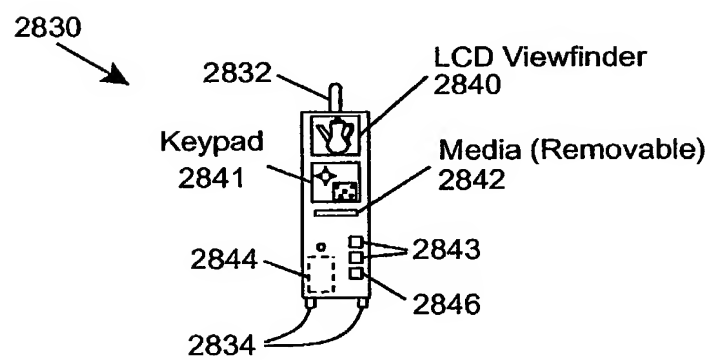
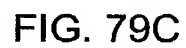
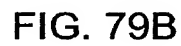
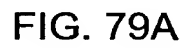


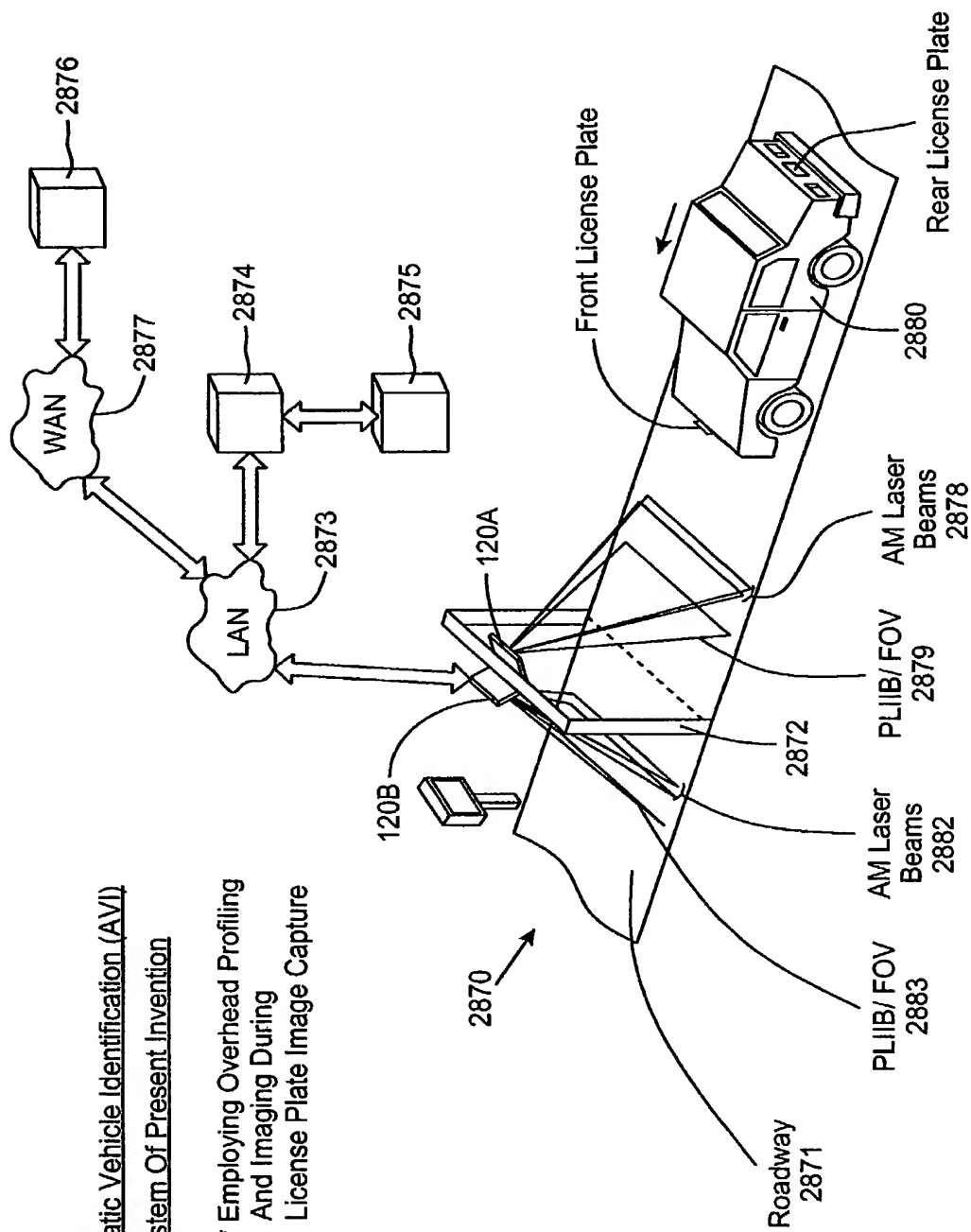
FIG. 78C





# Automatic Vehicle Identification (AVI) System Of Present Invention

### \* Employing Overhead Profiling And Imaging During License Plate Image Capture



## Automatic Vehicle Identification (AVI)

## \* Employing Overhead Profiling And Imaging Techniques During License Plate Image Capture

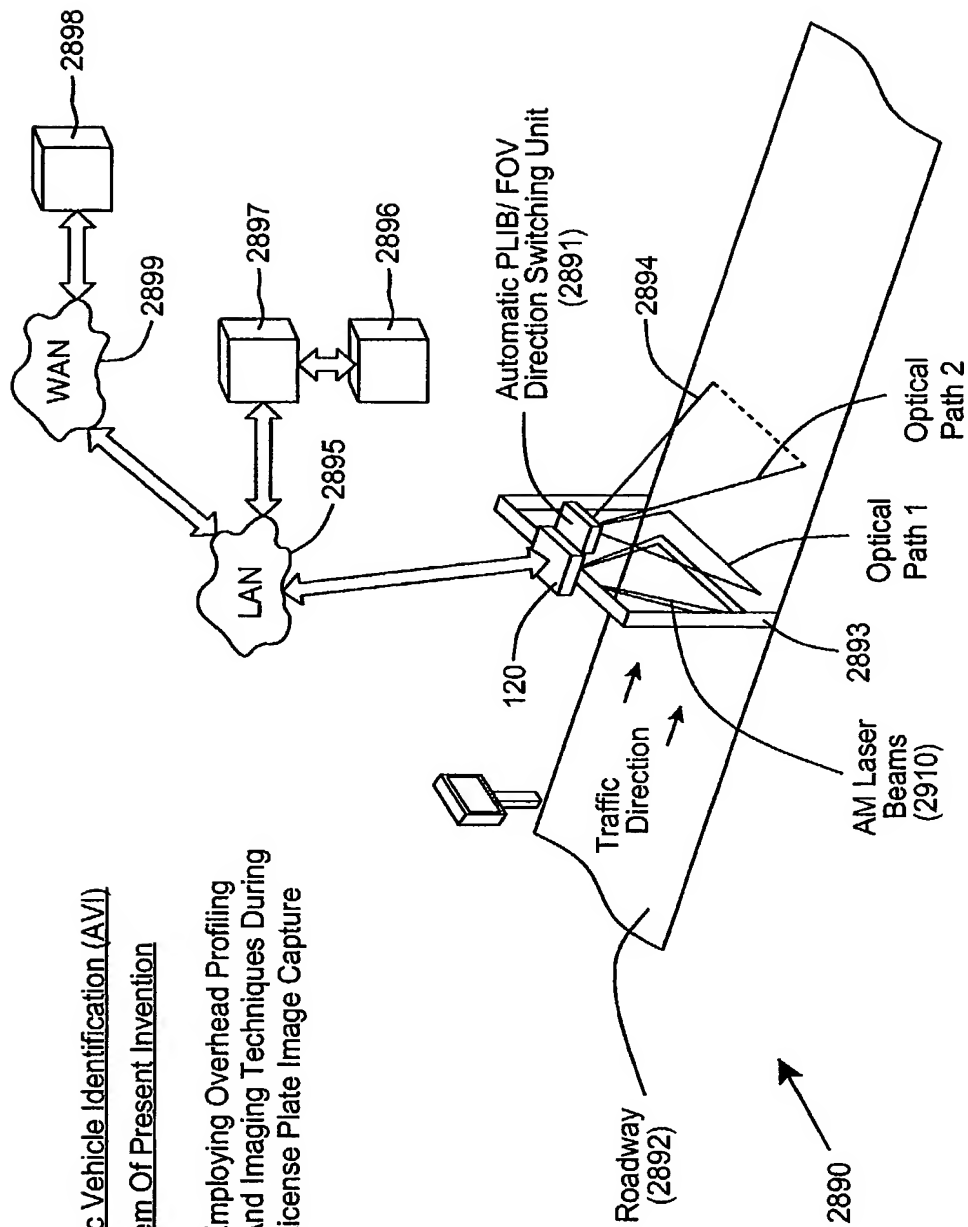
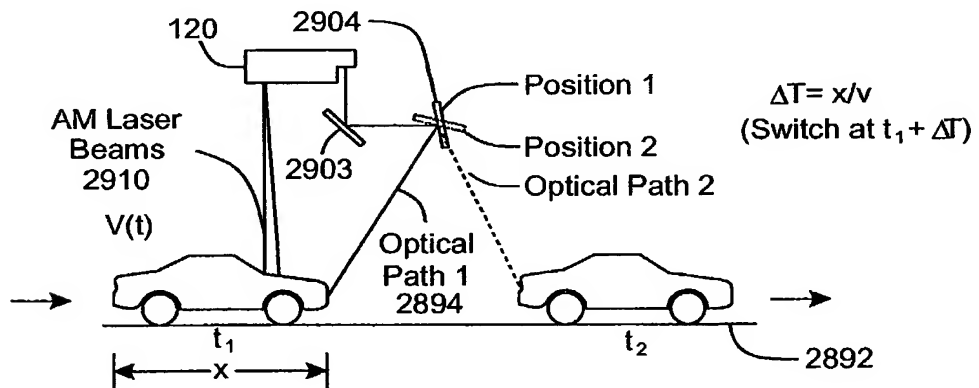
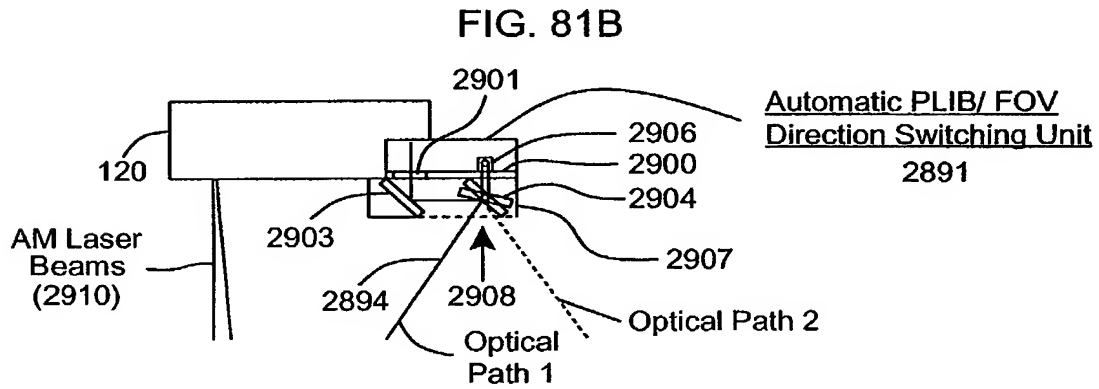
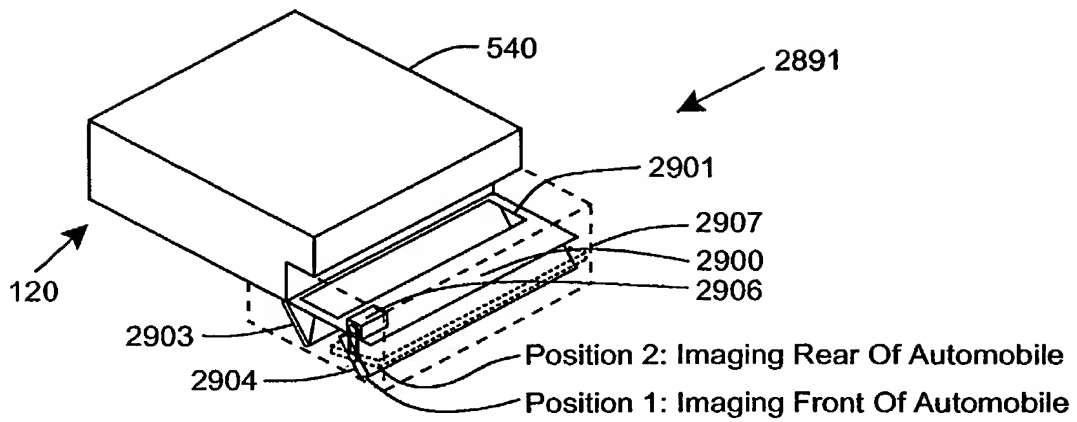
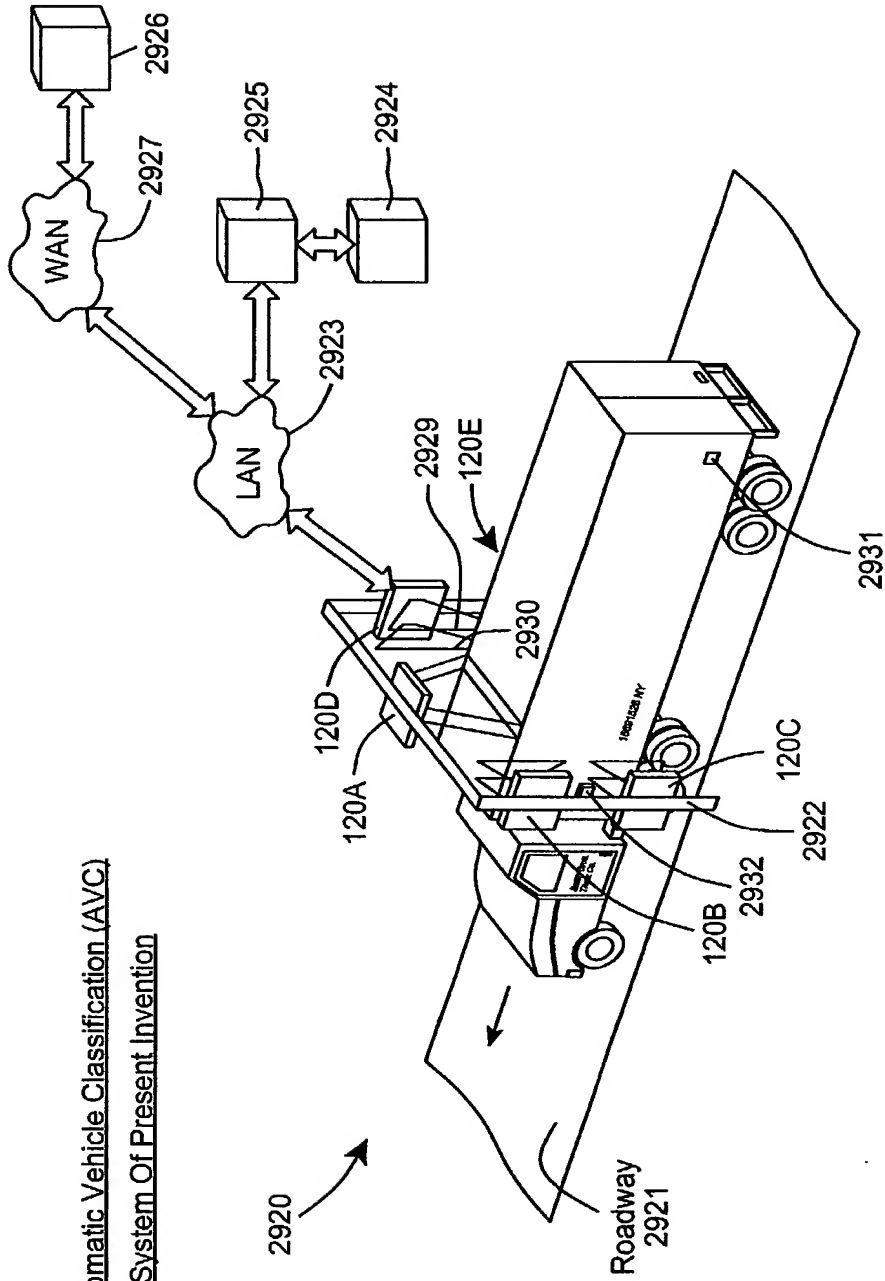


FIG. 81A



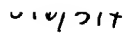
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Automatic Vehicle Classification (AVC)  
System Of Present Invention

\* Employing Overhead And Lateral  
Profiling And Imaging Techniques

FIG. 82

[illegible]

**FIG. 83**



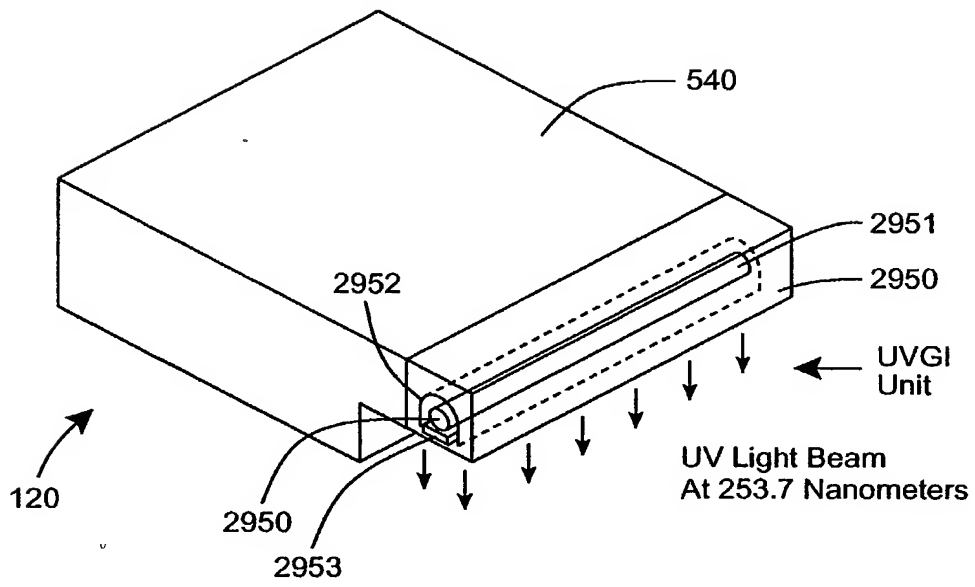


FIG. 84A

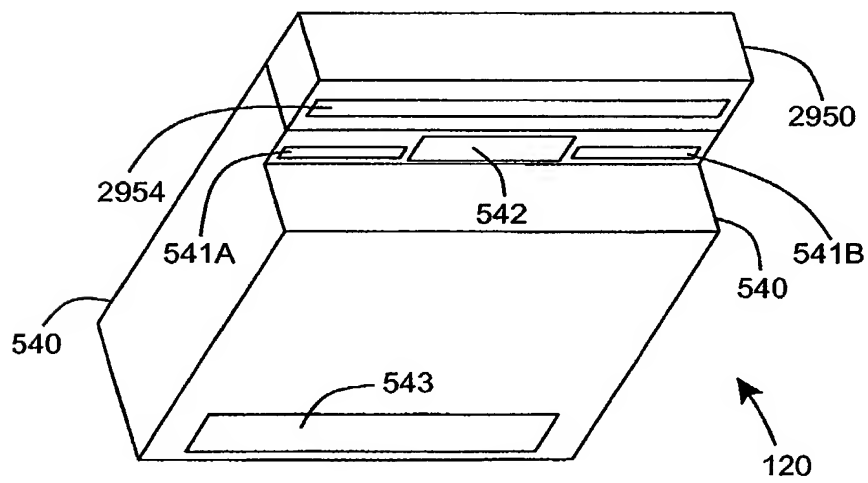


FIG. 84B